W.L.P.I.
8

Jan. 1929

Electrical Manufacturing

1687
3995

Vol. 3 A Gage Publication No. 1

The Acknowledged Standard of Quality Since 1884

Pyroxylin Lacquers

for every industrial purpose

THE ZAPON COMPANY
STAMFORD, CONN.

CHICAGO
CLEVELAND
DETROIT

LOS ANGELES
NEW HAVEN
NEW YORK

OAKLAND
PORTLAND
SAN FRANCISCO

SEATTLE
STAMFORD
WILMINGTON

TK1
.E362

Delta-Star Selects Belden Braided Copper Cable

Every item that goes into Delta-Star high-tension equipment is laboratory tested. Only materials of highest quality are used. Consequently it should be of great significance to users of flexible lead wires that Delta-Star uses thousands of pounds of Belden Braided Copper Cable for flexible connectors on their high-tension switches.

From the heavy 1½ inch flexible braid supplied to Delta-Star to the finest braided leads of the most delicate instruments, Belden offers a complete service in both bare and insulated braided and stranded flexible lead wire. There is a Belden Flexible Lead Wire for every purpose. Write for complete information stating your requirements.

Belden Manufacturing Company

2310-B South Western Ave. **Chicago, Ill.**

BELDEN PRODUCTS

Beldenamel and Textile Magnet Wire
Coil Windings
Beldenmold (Molded Bakelite Products)
Automotive Wires and Cables
Airplane Assemblies
Radio Wires, Cords and Cables
Rubber Covered Wires
Armored Cables
Flexible Armature Wires
Motor Lead Wires
Braided and Stranded Copper Cables
Cotton Sleeving

Specify Belden

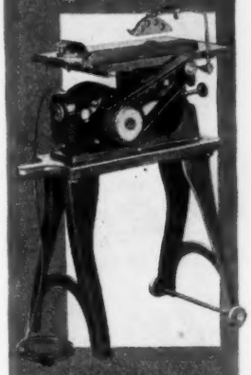
Positive Proof!

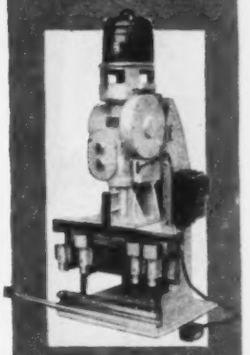
POSITIVE proof that Master Motors make good is had from the fact that our customers continue to buy these motors in ever-increasing quantities. This success and popularity of Master Motors is based upon a background of successful applications.

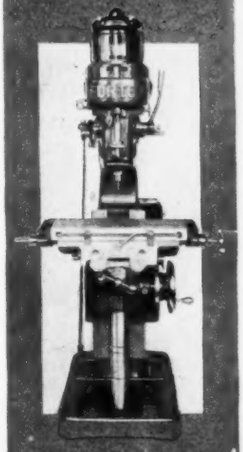
On hundreds of these applications (a few typical ones are shown) Master Motors are delivering the kind of service that satisfies. These motors are the product of our long-established policy of continuous refinement that brings to the user a much longer motor life, less maintenance and service expense and *greater satisfaction* at no increase in initial cost.

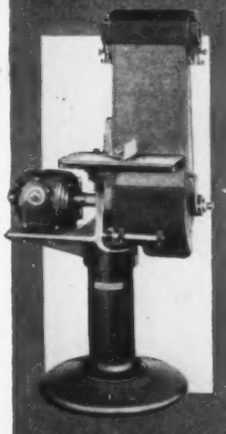
Complete details will gladly be given on request.

THE MASTER ELECTRIC COMPANY
Dayton, Ohio









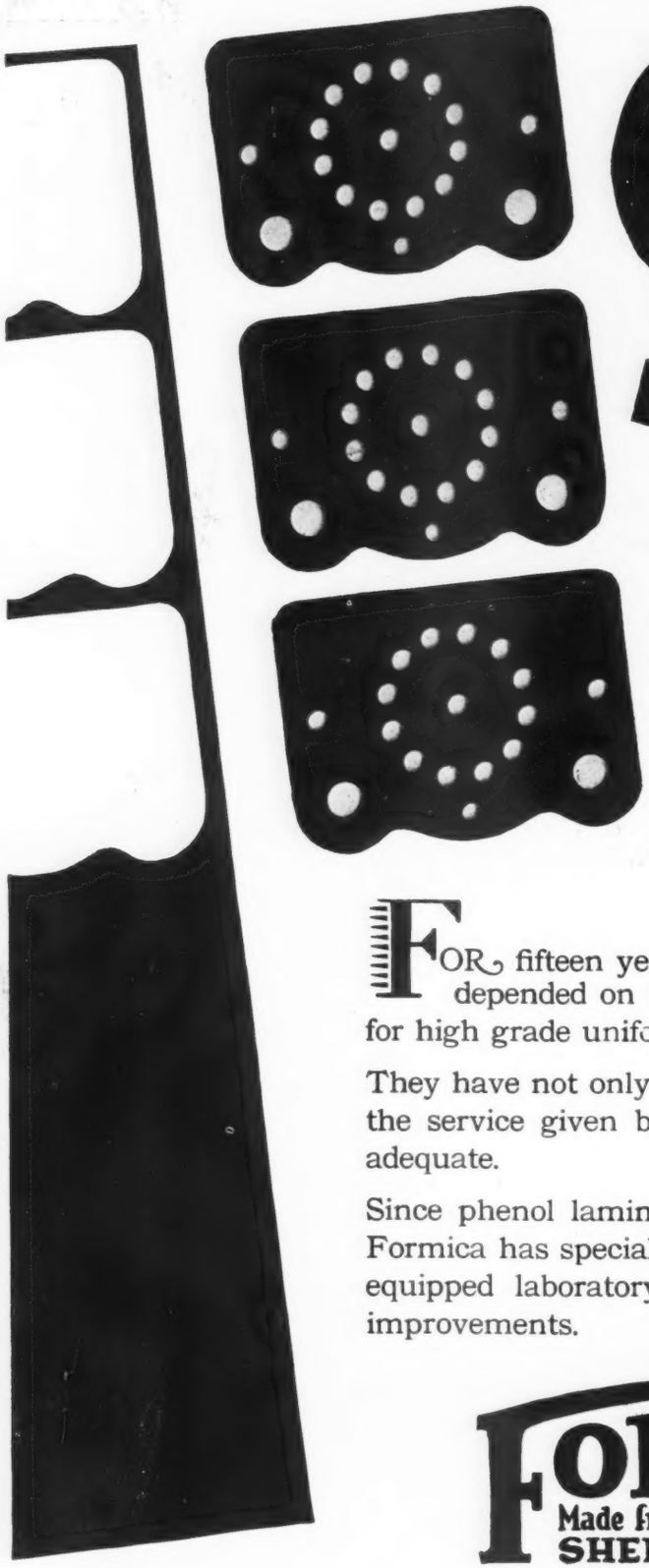
STOCKS CARRIED IN PRINCIPAL CITIES

More Than 70 Service Stations

MASTER GUARANTEED MOTORS

1/20 TO 10 H.P. Less than 40°

Dayton THE MASTER ELECTRIC CO. Ohio



GOOD INSULATION *Promptly and Accurately!*

FOR fifteen years, American electrical men have depended on the Formica Insulation Company for high grade uniform insulation.

They have not only found the quality satisfactory but the service given by the largest unit in its industry adequate.

Since phenol laminated products were first produced, Formica has specialized on just one product. A well equipped laboratory is constantly trying for further improvements.

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

The FORMICA INSULATION CO. *4626 Spring Grove Ave.* CINCINNATI, OHIO

Electrical Manufacturing

Reg. U. S. Patent Office

• Production • Marketing • Administration • Repairing •

H. L. Hildenbrand, *Managing Editor*
William W. Baxter, *Associate Editor*
Stanley A. Dennis, *Editor*
D. H. Braymer, *Consulting Engineering Editor*
Leslie H. Allen, *Associate Editor*
Edward H. Dutcher, *Production Editor*

Volume 3 JANUARY, 1929 Number 1

Contents of This Issue

Wholesalers' Suggestions to Manufacturers 21
Overlapping Association Activities..*Frederic P. Vose* 22
Coordinated Selling .....*E. H. Campbell* 25
Maintenance of Electric Trucks.....*C. B. Crockett* 28
Business Outlook for 1929..... 31
Franklin Specification for Good Lighting..... 32
Facilities Needed for Making Circuit Breakers.....
William W. Baxter 34
Methods and Equipment in Circuit Breaker Construction 37
Sales Engineers Taught to Know the Product.....
B. T. Cormick 41
Measuring Instruments and Methods..*D. H. Braymer* 43
Characteristics Determining Motor Selection.....
Theodore Schou and C. P. Robinson 46
Editorials 50
Avoid Errors in Ordering Stampings..... 52
A Stampings Expert Tells of Savings....*J. K. Olsen* 53
What's Nema Doing?..... 55
Correcting Electric Motor Troubles.....
William M. Wallace 56
Mechanical Transmission for Motor Drives..... 59
Hard Rubber Uses in the Electrical Industry.....
William Crawford Hirsch 63
Electric Toaster Components..... 65
Electrical Manufacturing News..... 68

Trust Laws and Economics

HOW much the abandonment of the "gentlemen's agreement" and other similar practices has been due to the strong arm of the anti-trust laws and how much to the normal operation of economic forces might be a moot question, but it is still debated.

E. W. McCullough, manager of the Department of Manufacture of the Chamber of Commerce of the United States, holds that "gentlemen's agreements" failed mainly because they were economically unsound.

"There has been much clamor," he says in an address before the Laundry-owner's National Association, "for the amending of our trust laws to permit industries and their organizations to regulate competition on a basis to insure fair profits, but, without questioning the honesty of purpose of such proposals, the economic impossibility of realization is readily seen.

"If an association truly represents an industry, it includes plants of all sizes and conditions. In such a grouping are the efficient and the inefficient —the high-cost factory as well as the low-cost factory. To give them equal protection prices and competing conditions must be arranged to take care of all classes. It simply cannot be done that way, for a price which would give the high cost member a fair profit would give the efficient low-cost man too much. Even if the law permitted an association to arrange such a protection for the members of its industry, the operation of the economic law—supply and demand—would destroy such a set-up."

Published Monthly and Copyrighted by

The Gage Publishing Company, Inc.

Nelson W. Gage, *President*
J. F. McClure, *Vice-Pres. and Secretary*
J. C. Prior, *Treasurer*
Stanley A. Dennis, *Editor and Assistant to President*
L. C. Fletcher, *Advertising Manager*

Subscription Rates: United States, Canada, Mexico, $2.00 a year. Foreign Countries, $3.00 a year. 25 cents a copy.
Application for entry as second class matter is pending

461 Eighth Avenue, New York, N. Y.

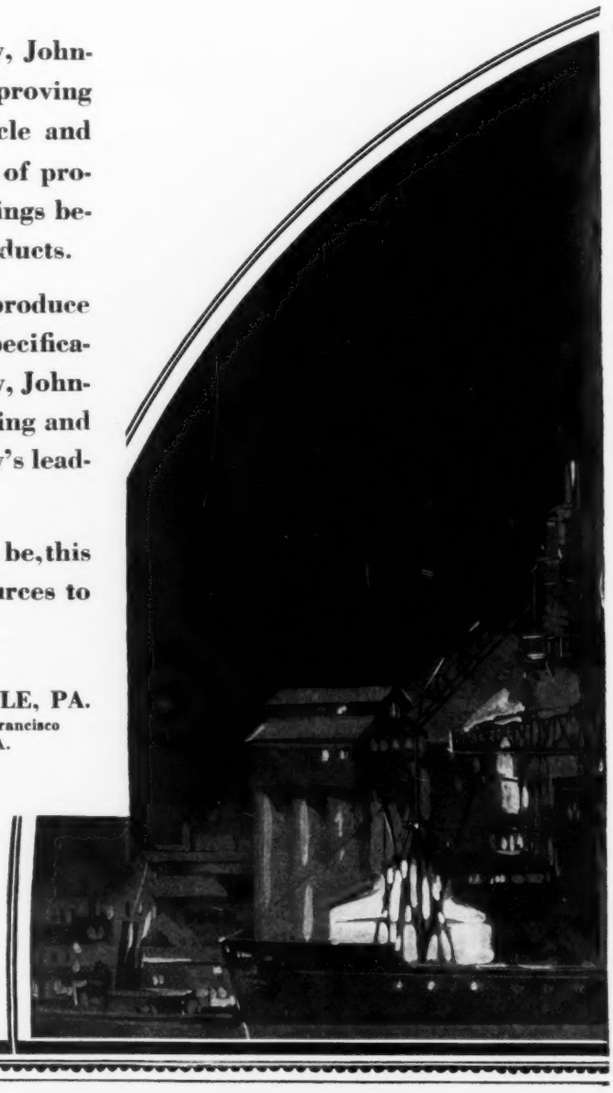
Chicago Office: 1742 Monadnock Block, L. C. Bassett, *Manager*
Cleveland Office: 501 Caxton Building, Harry Krohn, *Manager*

A Servant of all a Specialist for many

YEAR after year, for a quarter-century, Johnson Bronze has had the privilege of proving to an increasingly large number of vehicle and machinery builders and users that the job of producing finished bronze bushings and bearings belongs to the specialized maker of such products.

Equipped both mentally and physically to produce these important bronze parts to exacting specifications, not just on occasion but continuously, Johnson Bronze now serves as the bronze bushing and bearing department of many of the country's leading industrial manufacturers.

Whatever the bronze bearing problem may be, this organization has the experience and resources to solve it efficiently and economically.



JOHNSON BRONZE COMPANY, NEW CASTLE, PA.
New York, Chicago, Detroit, Cleveland, Kansas City, San Francisco
Export Address: 130 W. 42nd St., New York City, U. S. A.
Cable JONBRON

JOHNSON

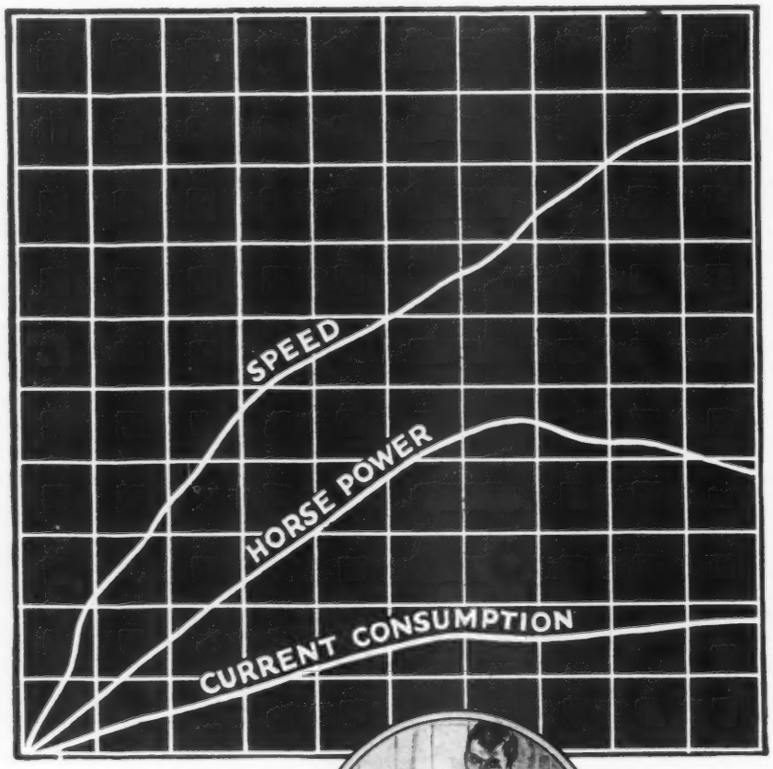
BUSHINGS BAR

BRONZE

BRONZE BEARINGS

If you need
High Speed
Maximum Horse power
Low Current Consumption

Investigate Dumore



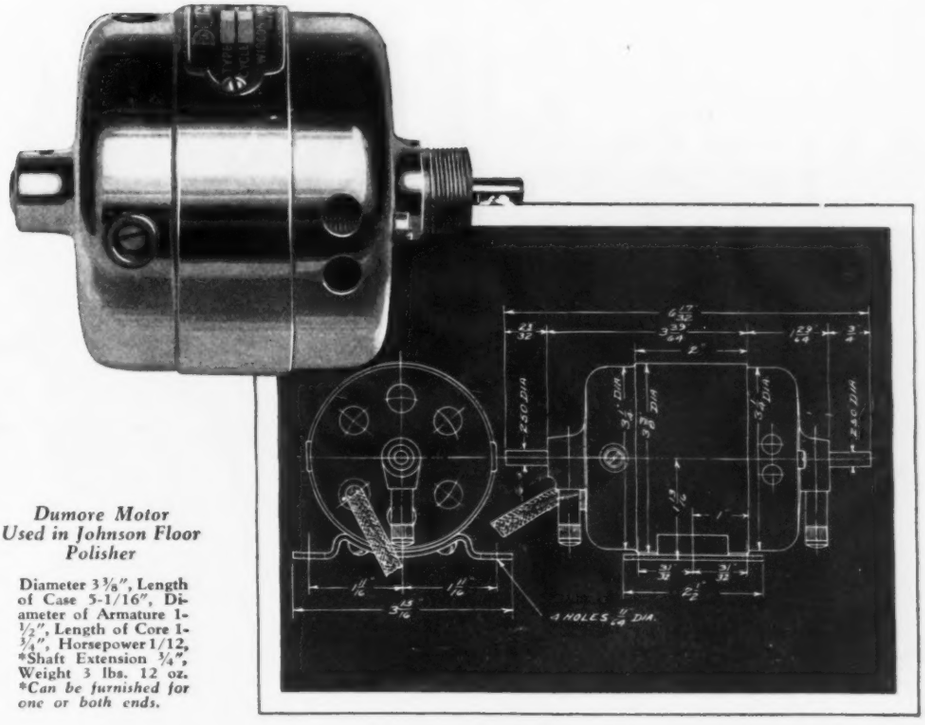
THE fact that Dumore Motors are designed, developed, and manufactured by engineers and craftsmen, who have had 25 years experience in the production of Universal motors, is of tremendous economic importance to you.

Dumore construction embodies unusual features of speed, strength, economy in cost and operation, *and dynamic balance for long life.* The superiority of the Dumore Motor lies to a great extent in this last-named advantage. Through careful assembly of parts which are in themselves balanced, and through the final rigid test which checks the performance of every motor, destructive vibration has been completely and successfully eliminated.

If you want Quality in a tangible and measurable form—the kind the buyers of your product instantly recognize—investigate Dumore today!

Dynamic balance of Dumore armatures is secured on special balancing machines of our own design and construction. Smoothness, quietness, and reduction of bearing trouble to a minimum are thus assured in all Dumore Motors.

DUMORE



Dumore Motor Used in Johnson Floor Polisher

Diameter 3 3/8", Length of Case 5-1/16", Diameter of Armature 1-1/2", Length of Core 1-3/4", Horsepower 1/12, *Shaft Extension 3/4", Weight 3 lbs. 12 oz.
**Can be furnished for one or both ends.*

The Popular Johnson Floor Waxer is powered with a DUMORE Motor

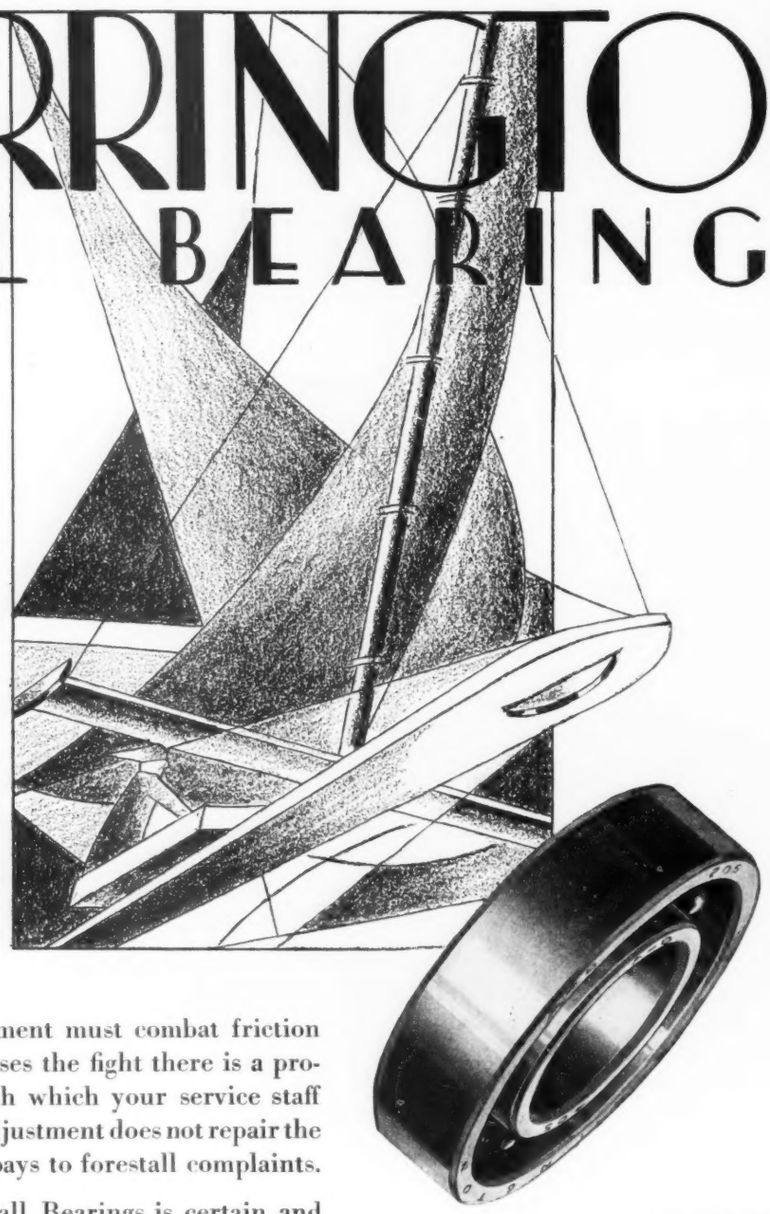
IN 200,000 homes and offices throughout the world the Johnson Floor Polisher performs its brightening and beautifying service every day. The Dumore Motor that drives this household accessory is hidden from the eyes of its users—unnoticed except for its unfailing dependability month after month. You can't see the extra strength and quality built into Dumore Motors but it's there—the enthusiastic users of S. C. Johnson & Son equipment testify to that! Many manufacturers are now using Dumore Motors for operating window advertising displays, special testing and calibrating machines, moving picture projectors, blowers, chiropodists' drills, grinding outfits for shaping crystals and lenses, and many other applications of this type.

Dumore fractional horsepower motors can be supplied to fill any requirements for a Universal type of motor. Power saving—longer life—greater user satisfaction—these are the advantages offered by the Dumore. In every phase of their manufacture skilled engineers and workmen seek to assure for every motor the maximum period of dependability. Dumore Motors obtain speeds of from 12,000 to 14,000 R. P. M., but they develop their maximum horsepower at 5,000 to 6,000 R. P. M. They can be built to operate at much lower speeds where special conditions permit. If you desire evidence that the Dumore will do your work a little more effectively than it has ever been done before, write our Engineering Research Department today!

WISCONSIN ELECTRIC COMPANY
35 SIXTEENTH STREET, RACINE, WISCONSIN

FRACTIONAL HORSE POWER MOTORS
ARE DYNAMICALLY BALANCED!

TORRINGTON BALL BEARINGS



YOUR designing department must combat friction at every point. If it loses the fight there is a procession of complaints with which your service staff must deal. Even prompt adjustment does not repair the damage to prestige, so it pays to forestall complaints.

The use of Torrington Ball Bearings is certain and economical protection. They are assurance that machines so equipped will perform smoothly and powerfully under the strictest operating conditions.

Torringtons meet the specifications of experienced designers. They function with a minimum of friction. And their construction is typical of the fine precision methods of the Torrington organization.

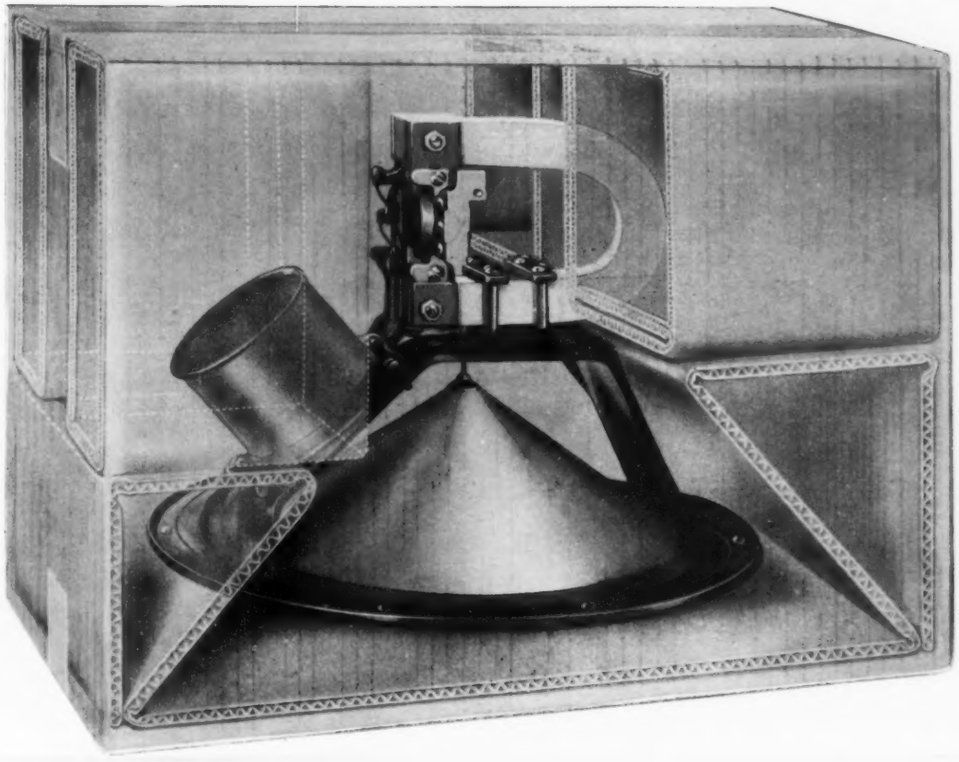
DISTRICT SALES REPRESENTATIVES:

S. W. Anderson
565 W. Washington Blvd.
Chicago, Ill.

Gibson & Hodgson
2315 Dime Savings Bank Bldg.
Detroit, Mich.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

GAIR
CORRUGATED CASES



THIS is a phantom picture of a Corrugated Shipping Case so equipped with stabilizing cells and restraining stalls that the sensitive and fragile loud speaker packed within retains its poise no matter on what side or end the Case is pitched. The article is virtually suspended and safe from vibratory shock.

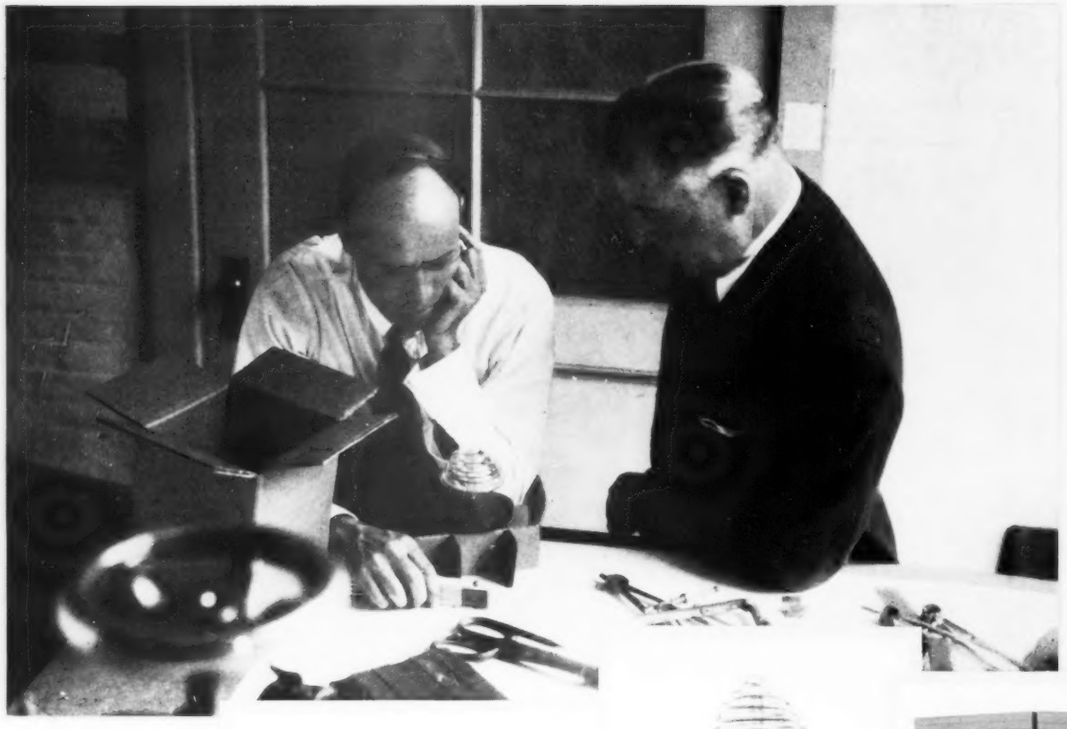
Packing problems of this sort are interesting. It is hard to safely pack and maintain the equilibrium of articles of uncentered weight, but as yet we have had no reasonable problem that we have not solved. In the instance of the illustrated Corrugated Case, Engineer Malcolmson says: "We threw the Case all over the Laboratory to bring to light its weakest point. Then, building a new design to protect this, we went through the same process with each successive Case until we achieved a perfect carrier with the heavy magnet firmly locked."

In this practical way, Gair Engineers diagnose Corrugated Case weaknesses and by scientific methods correct them. This interesting Laboratory service, is available to you. There is also a clinic for improving the efficiency of badly developed Corrugated Cases and such as fail your requirements.

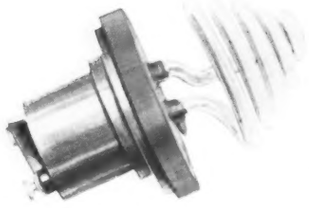
ROBERT GAIR COMPANY

420 LEXINGTON AVENUE, NEW YORK

GAIR PROTECTIVE PACKING

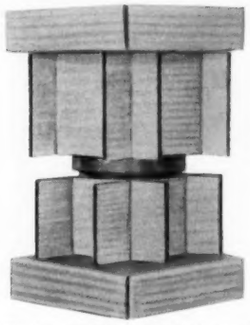


Artificers in the Gair Laboratory have agenius for contriving safe carriers for frail merchandise.



Glass spiral on slender stems imbedded in a solid base.

The base is trapped immovably in a cell.

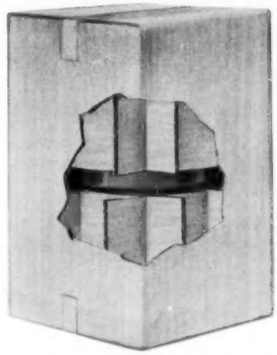


The glass spiral rigidly held within a hood.

ASIDE from the specially contrived Corrugated Containers for products of great susceptibility to breakage, the enormous "Tonnage" output of Robert Gair Company's Plant goes to packers of standard canned goods and to shippers of every form of package merchandise.

The excellent color printing on Gair Corrugated Cases has spirited advertising value —the application of heavy inks smoothly and neatly is a Gair manufacturing trait very serviceable to the customer and peculiar to Gair Quality.

Gair Corrugated Shipping Cases are of upstanding structure and sound substance. The Jute Liners and the tough, yet flexible, Straw that go into them are produced at Gair Mills with the purpose of getting all the resistance to colliding violence that a sound Corrugated Case should have.



The whole set within the sheltering walls of a Corrugated Case for transportation.

Five Box Board Mills. 1000 tons daily

ROBERT GAIR COMPANY

GRAYBAR BLDG., 420 LEXINGTON AVE., NEW YORK CITY

Rising to the needs of a Great Industry

The requirements of the electrical industry are more and more exacting.

As electrical products improve, coils must be more accurate to keep pace with the fine calibrations of the electrical engineer.

This is why the world's most successful radio manufacturers in the electrical, ignition and radio fields turn to Dudlo for coils.

Dudlo coils are not only wound accurately, but every part and material from the core to the outside wrapping is selected and applied with skill; a skill which could only come from an organization trained over many years of making millions upon millions of coils for every electrical need.

The Coil's the thing!

No electrical unit is better than its coil, and no coil is any better than the wire in its windings. Dudlo draws and insulates the wire and controls every part and process from the copper rod to the finished coil. A complete service to the electrical industries.

DUDLO MANUFACTURING COMPANY, FORT WAYNE, INDIANA

56 Earl St.
Newark, N. J.

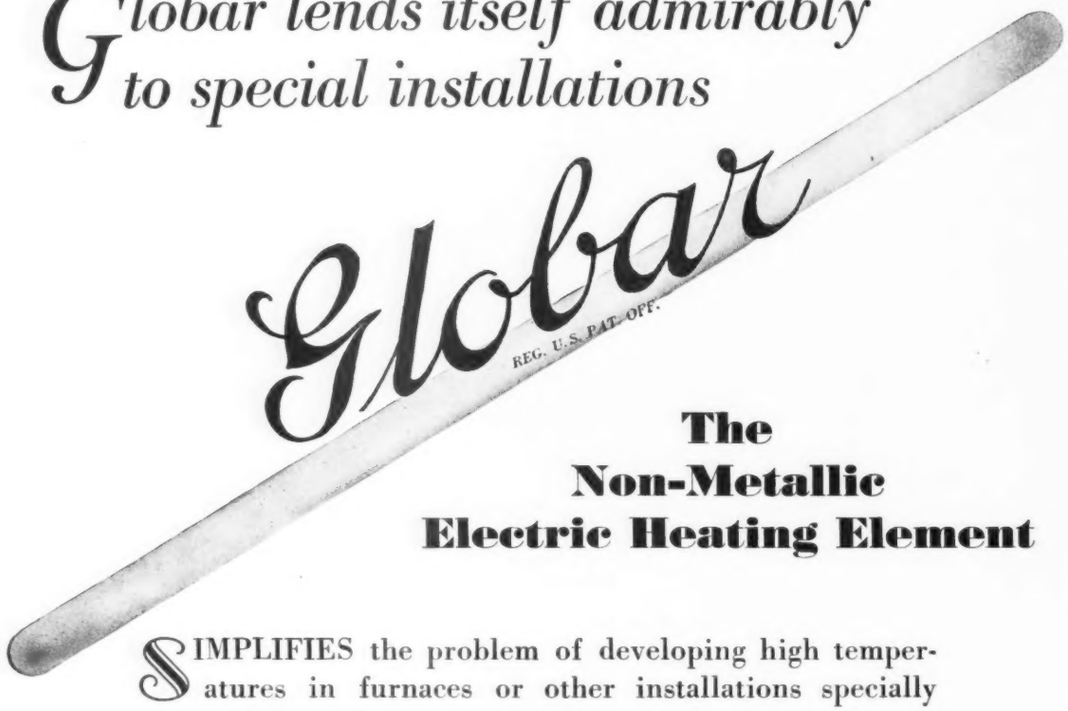
105 W. Adams St.
Chicago, Ill.

Division of
THE GENERAL CABLE CORPORATION

274 Brannan St.
San Francisco, Cal.

4143 Bingham Ave.
St. Louis, Mo.

Globar lends itself admirably to special installations



The Non-Metallic Electric Heating Element

SIMPLIFIES the problem of developing high temperatures in furnaces or other installations specially designed for either experimental or production work.

Because of the simplicity of Globar Terminal Mounting—because the Globar Non-Metallic Element is easily installed—quickly replaced—because it is possible to handle high wattage and develop high temperatures with a heating element that occupies comparatively much less space—

And because Globar permits of far greater flexibility in construction—the problem of design is greatly simplified and effective economical operation assured.

Globar is a Carborundum Reg. U. S. Pat. Off. *Product*

If you have a special electric heating problem involving temperatures up to 2750° Fahrenheit our engineering department will be glad to assist in its solution. . .

Our Bulletin D-7 gives details regarding Globar Terminal Mountings.

GLOBAR CORPORATION, NIAGARA FALLS, N. Y.

(Globar is the registered trade name given to non-metallic electrical heating and resistance materials, and to other products of Globar Corporation, and is its exclusive property.)

HORSE HEAD ZINC

FOR THE DIE CASTING INDUSTRY

The die casting industry appreciates Horse Head Zinc for the same reason that makes it the standard in older industries—*uniform quality*. The resulting uniformly high performance record has placed Horse Head Zinc at the forefront of the commercial slab zinc (spelter) field. ¶ Horse Head Zinc is used by leading die casters as the base for their zinc base alloys. ¶ In the automotive industry, carburetors, pumps, strainers, meters, cowl bars, radiator ornaments and a variety of other integral parts and accessories are die cast from zinc base alloys containing Horse Head Zinc. ¶ In the radio field, frames, dials, loud speakers, grills, cabinets and many other parts are die cast from zinc base alloys containing Horse Head Zinc. ¶ Gear housings, pumps, vending machines, ornamental pieces and electrical fixtures are a few of the countless general products die cast from zinc base alloys containing Horse Head Zinc. ¶ Under the name Zamak, The New Jersey Zinc Company has developed a die casting alloy, with Horse Head Zinc as its base. Again *uniform quality* has been the outstanding reason for the success achieved with Zamak. ¶ A profusely illustrated and readable booklet showing various Zamak die castings, and stating the alloy's properties, will be sent to anyone interested in die casting and its possibilities.

THE NEW JERSEY ZINC COMPANY
160 Front Street + New York, N. Y.

Our American Merchant Marine offers unrivalled shipping facilities to all parts of the World

THE fast freight services operated for the United States Shipping Board provide American manufacturers and producers with dependable, economical transportation to practically all parts of the world. These services consist of 22 lines with a total of 256 vessels. Sailings are on regular schedule from Atlantic Coast and Gulf ports for the United Kingdom, Irish Free State, Continental Europe, South America, the Orient, Dutch East Indies, Australasia, India and Africa.

Whether you are already engaged in foreign commerce or are just starting the development of an export trade, it will pay you to look into the many advantages offered by these American Flag services. The advice and counsel of the experienced Shipping Board operators is always available to help solve your shipping problems and to show you the quickest, most economical way to handle your exports or your imports.

For complete information on either freight or passenger services write for "Trade Routes and Shipping Services," a comprehensive booklet issued for American manufacturers and producers interested in foreign commerce.

*AMERICA FRANCE LINE
42 Broadway, New York City
N Atlantic to French Atlantic ports

*AMERICAN BRAZIL LINE
17 Battery Place, New York City
Atlantic ports to ports in Northern Brazil

*AMERICAN DIAMOND LINES
67 Exchange Place, New York City
North Atlantic Ports to Holland, and Belgium

DIXIE UK LINE
New Orleans, La.
New Orleans to United Kingdom

AMERICAN MERCHANT LINES
17 Battery Place, New York City
Passenger and freight services to United Kingdom

*AMERICAN INDIA LINE
11 Broadway, New York City
North Atlantic ports to Indian ports

*ATLANTIC AUSTRALIAN LINE
11 Broadway, New York City
New York to Australian ports
Periodically the above two lines combine on an around-the-world Service

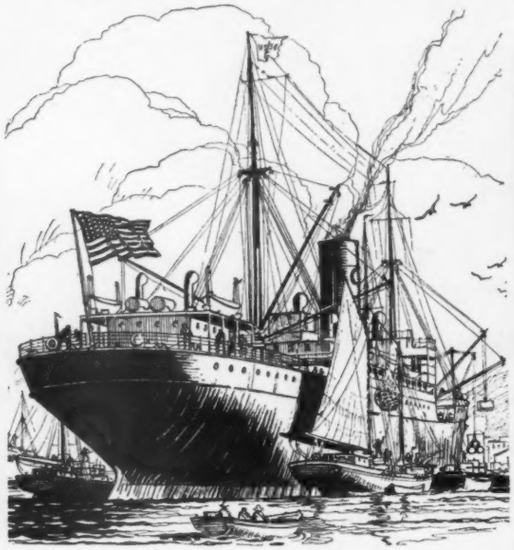
DIXIE MEDITERRANEAN LINE
New Orleans, La.
New Orleans to Mediterranean ports

GULF BRAZIL RIVER PLATE LINE
Hibernia Bank Bldg., New Orleans, La.
Gulf ports to east coast of South America

MISSISSIPPI VALLEY EUROPEAN LINE
Hibernia Bank Bldg., New Orleans, La.
New Orleans to French and Belgian ports

GULF WEST MEDITERRANEAN LINE
917 Whitney Building, New Orleans, La.
Gulf and South Atlantic ports to Portuguese, Spanish, and North African ports (west of Bizerta)

**Accommodations available for a limited number of passengers on these lines.*



In addition to the services listed, sixteen American Flag lines developed and formerly controlled by the Shipping Board but now under private ownership, offer the same facilities for safe, dependable transportation.

Passenger Services—Buyers traveling to European ports will find accommodations of their choice on the fast passenger vessels of the United States Lines which include the Leviathan, world's largest ship. The American Merchant Lines vessels, sailing weekly from New York, also offer comfortable passage at reasonable rates.

UNITED STATES SHIPPING BOARD

Merchant Fleet Corporation

WASHINGTON, D. C.

YANKEE LINE
110 State Street, Boston, Mass.
North Atlantic ports to German ports

MOBILE OCEANIC LINE
Mobile, Ala.
Mobile and Eastern Gulf ports to United Kingdom and continental European ports

AMERICAN PIONEER LINE
Atlantic Division
11 Broadway, New York City
N. Atl. ports to Orient and Dutch E. I.

AMERICAN PIONEER LINE
Gulf Division
917 Whitney Bldg., New Orleans, La.
Gulf ports to Orient and Dutch E. I.

AMERICAN REPUBLICS LINE
33 Broad Street, Boston, Mass.
N. and S. Atl. ports to Brazil and River Plate ports, east coast of S. America

ORIOLE LINES
Citizens Natl. Bank Bldg., Baltimore, Md.
North Atlantic ports to west coast of United Kingdom and Irish ports

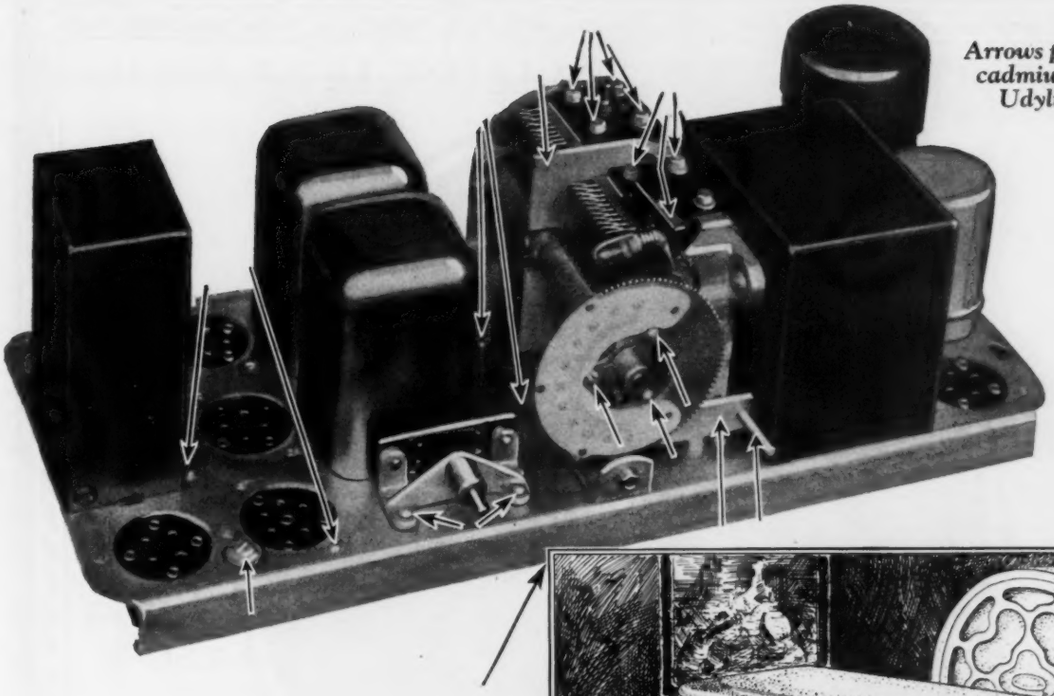
SOUTHERN STATES LINE
925 Whitney Central Building, New Orleans, La.
New Orleans and Texas ports to German and Holland ports

TEXAS MEDITERRANEAN LINE
Cotton Exchange Bldg., Galveston, Tex.
Texas ports to Mediterranean ports

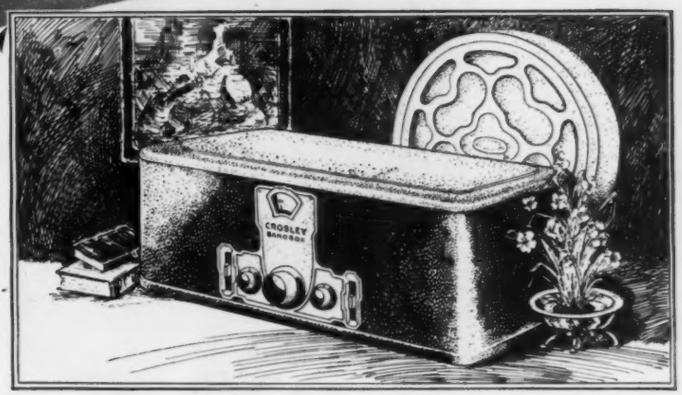
TEXAS UKAY LINE
Galveston, Texas
Texas ports to United Kingdom ports

TEXAS STAR LINE
New Orleans, La.
Texas ports to French and Belgian ports

UNITED STATES LINES
45 Broadway, New York City
Passenger, mail, freight services to England, Ireland, France and Germany



Arrows point to parts cadmium plated by Udylite process



CROSLEY

VITAL PARTS *of Showbox Chassis* PROTECTED AGAINST RUST

The dependable operation of the Crosley, one of the world's most popular radio sets, is due in a large measure to the fact that connection posts and bolts are Udylited, insuring against rust and corrosion. ¶ Engineers are finding Udylite unequaled as a rust proofing agent and an untold economy in thousands of varying applications. ¶ The story of how Udylite will help to solve your manufacturing problems will be sent you upon request.

Udylite
RUST PROOFS
REG. U S PAT OFF.

THE UDYLITE PROCESS COMPANY *Detroit Mich.*
3220 BELLEVUE AVE.

AFFILIATED WITH THE GENERAL CHROMIUM CORPORATION

THE WORLD'S GREATEST AND LATEST LIGHT METAL

CHAS. B. BOHN

The authority who developed

BOHNALITE

62% LIGHTER THAN IRON

Here is a new light metal that is destined to revolutionize the practices of thousands of manufacturing companies.

For Bohnalite—a new light alloy—has already replaced the use of iron and steel in many and various American industries.

Bohnalite is 62% lighter than iron. Bohnalite has all the advantages of iron. Bohnalite possesses many highly important merits which are lacking in iron.

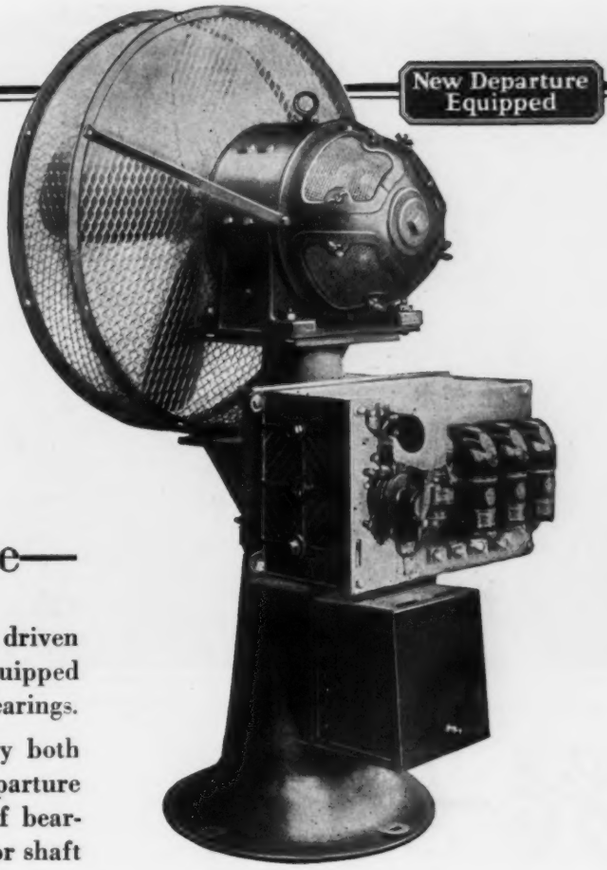
In Bohnalite you get unusual strength—unusual lightness—long life—a non-rusting metal that wears like iron. Easy to machine—easy to handle in the shop.

Tell us about your requirements. Let us tell you more about Bohnalite—its physical properties and the large number of large industries that are using a large volume of Bohnalite.

Write for interesting new descriptive Bohnalite booklet.

BOHN ALUMINUM & BRASS CORPORATION, DETROIT, MICHIGAN

NEW YORK CHICAGO PHILADELPHIA CLEVELAND PITTSBURGH



Fewer Bearings Required, Because—

THE Robinson Man Cooler is driven by Reliance D. C. motors equipped with New Departure Ball Bearings.

Because of their ability to carry both radial and thrust loads, New Departure Ball Bearings reduce the number of bearings required in fans where the motor shaft and fan shaft are integral.

The ball bearings carry radial loads imposed by the weight of fan and rotor as well as the thrust load imposed by the fan, functioning with so little friction and wear that bearing adjustments are never necessary.

Lubricant is sealed within the bearings by effective closures and replenishment is needed only annually.

Ball bearing advantages in electric motors and motor-driven mechanisms are fully discussed in "Booklet K" and "Cutting Your Costs." Sent on request.

New Departure Ball Bearings

The New Departure Manufacturing Co.
Bristol, Connecticut
Chicago • Detroit • San Francisco

1066

G-E Flex Cord with moulded rubber plug is used on the General Electric Cleaner

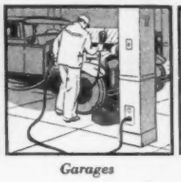
G-E Flex
—the electric cord that does not kink

Lighting

Household Appliances

Construction Machinery

Electric Drills



Garages

Offices

Washing Machines

Vacuum Cleaners

Of vital importance on any portable electric appliance or tool, is a cord that will not kink. G-E Flex is all-rubber covered . . . and extremely flexible. Neither acid, oil nor water will harm it. It resists abrasions and has high tensile strength. It can be obtained in specified lengths with a moulded rubber plug, ready for use.

General Electric has developed G-E Flex as the perfect cord for garage tools, vacuum cleaners, portable lamps, washing machines and countless other applications.

G-E Flex is obtainable on spools, or in cord sets with moulded rubber plug permanently attached, ready for assembly. Send the coupon for further details.

Section W-231, Merchandise Department,
General Electric Company,
Bridgeport, Connecticut.

Send me complete information on G-E Flex all-rubber electric cord and cord sets.

Name .....

Company .....

Address .....

GENERAL ELECTRIC

JAN 18 1929 ©CIB 13574

Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 3 JANUARY - 1929 Number 1

Suggestions

REPORTS of Merchandise Committees of the National Electrical Wholesalers Association at the recent semi-annual convention contain the following suggestions to electrical manufacturers.

SWITCH BOX manufacturers are requested to discontinue the system of showing both catalog number and universal number on switch boxes, that a simple set of universal catalog numbers be adopted, and that a similar new system be provided for numbering outlet boxes and covers.

LAMP manufacturers are requested to consider the advisability of reducing the minimum basis of the present $150.00 A contract to $125.00, and the minimum basis of the present $300.00 A contract to $200.00 with compensation on a basis which cost studies indicate should approximate 23% and 25% respectively, and also that manufacturers make a study to determine if a change in the classication of A agents, $600.00 and above, would seem advisable.

POLE LINE HARDWARE manufacturers are requested to consider the advisability of a cost accounting study to determine the actual expense of making direct shipments for distributors in less than carload quantities.

FAN manufacturers should bear all expenses incurred in the replacement of defective fans including freight, and that the manufacturers endeavor through architects to encourage specifications in new buildings such as hotels, hospitals, office buildings, etc., which will permit of wall control of multi-speed motors equipped with lighting fixtures, and that a study of fan applications to domestic heating be made, particularly along the lines of increased draft of furnace, increased flow of heated air and more efficient distribution of warm air currents.

HEATING DEVICE manufacturers are requested to make a study of the wholesalers' cost of doing business, and of the wholesalers' ability to serve all classes of customers most economically.

THE WIRING DEVICES Committee suggested a joint study with manufacturers for the purpose of determining correct package quantities as adapted to present economic demand, and that a further study should be made with the idea of agreeing upon universal catalog numbers. Manufacturers are requested to issue but one form of price sheet to wholesalers and that that sheet should show net cost.

CABLE manufacturers are requested to have tags attached to each coil showing the number of feet in the coil.

RADIO TUBE manufacturers are asked to consider the advisability of a spread which cost studies indicate should be approximately 20% to the distributor in standard package quantities. It was further suggested that manufacturers consider the advisability of a retailer spread of approximately 40% based on cost experiences over a long period of merchandising, when tubes are purchased in standard package quantities, and 35% when purchased in smaller quantities. A consignment plan on tubes is suggested for consideration of manufacturers not to extend, however, to the retailer, and that distributors should be generally chosen from wholesalers who are experienced in the handling of electric, hardware, automotive, and musical lines, with reasonable standards of credit requirements, capital requirements, etc.

RECEIVING SET manufacturers are requested to give serious consideration to necessary distribution costs and also to the subject of obsolescence and defective merchandise, and the loss resulting therefrom which should be covered by the manufacturer's guarantee. Manufacturers are also asked to consider the advisability of modifying existing practices with reference to the extension of courtesy discounts which promote unfair price discrimination.

Overlapping Services in Our Trade

By Frederic P. Vose
Counsel, National Electrical Credit Association

TRADE associations are making valuable contributions to America's commercial and industrial progress, in fields of scientific and economic research, in statistics, in simplification and standardization of commodities, in promotion of arbitration, in development of national and foreign trade and in a thousand other directions.
Frederic P. Vose

HOW many trade associations are there? Nobody knows. The guess of the Chamber of Commerce of the United States of America and the United States Department of Commerce is somewhere in the neighborhoor of three thousand. The number of national, sectional and local associations in the electrical and allied industries is about 357.

Of what use are they? The Equitable Trust Company of New York has this to say:

"There are many good reasons why membership in your trade association is a distinct asset. Not the least is the information which it gathers for its members. For business success, a man must look beyond the confines of his immediate problems and keep abreast of his whole industry."

President-Elect Herbert Hoover, in his St. Louis address of November 2, said:

"We have in the last quarter of a century evolved a higher sense of organized cooperation than has ever been known before. We have ten thousand examples of this conscious cooperative development in the enormous growth of associational activities. Civic associations, chambers of commerce, trade associations, professional associations, labor unions, trade councils, farm organizations, farm cooperatives, welfare associations—these are so all-embracing that there is scarcely an individual in our country who does not now belong to one or more of them.

"They represent every phase of our national life, both on the economic and on the welfare side. They constitute a vast ferment toward a conscious cooperation. They have become a part of the very fabric of American life.

"Such cooperation strengthens the whole foundations of self-government and serves to maintain equality of opportunity and constructive leadership."

Vice-president Cheney of the American Exchange Irving Trust Company, echoes what financiers all over the country are urging:

"Bankers have a real interest in the educational work undertaken by trade associations. The time is not far away when, in addition to the usual questions asked of our depositors, we will want to know whether they are sufficiently progressive to affiliate with their national trade organization."

¶ Each association should be operated to render a needed service without encroaching upon the prerogatives of any other legitimate association within the allied electrical industries

We have completed a record-breaking year of quantity output in commerce and industry. Financial experts prognosticate another sustained period of prosperity for 1929. But where are the profits? There's the rub! Expansion of volume, lower unit costs, increased sales costs, price depression, cut-throat competition, taking unreasonable credit chances, abnormally bad debt losses and trade demoralization, have eaten up what would otherwise have been profits. Competitive pressure during the eleven months of 1928 forced to the wall 18,671 concerns, with liabilities aggregating $468,173,944, which would not meet changing economic conditions. This is an increase of 1.2 per cent over the same period of last year. It is the highest total recorded since 1922. Survival of the fittest in the sifting and weeding processes will be witnessed to a greater extent in 1929.

Coupling the fact of increasing number of trade organizations with the further fact of diminishing net, it is now the fashion to say that we are over organized, that there must be a ruthless pruning of expense, paring of overhead, etc. The trouble with this situation is that an executive bent on retrenchment indiscriminately cancels membership in organizations, the worth of which is unknown to him.

SHOULD BE *Avoided* *Association* ACTIVITIES

THE job for 1929 is to eliminate destructive credit competition from the electrical, radio, automotive, lighting fixture and kindred industries.

HOW?

By every manufacturer and wholesaler becoming a N.E.C.A. member. And each being 100 per cent loyal to his membership obligation which calls for frank and free reciprocity.

WHEN?

In reporting methodically and promptly adverse credit and collection experiences to the N.E.C.A. to prevent needless loss by timely notice to the cooperating membership.

WHERE?

Every member, everywhere in all allied lines contributing his mite to the mass of ledger facts for the guidance, protection and profit of the entire industry throughout the United States.

WHY?

Because trade is interstate, as well as intrastate. There must be no sectionalism or divisions. The whole industry will prosper if each member does his full duty in the mutual service of the N.E.C.A.

RESULTS?

Safe and sound business. Incompetents known and avoided. Sales consummated. Receivables collected. Turnover quickened. Attorney's fees and commissions saved. Profits increased. Salaries advanced. Dividends earned and paid. Complete saturation of cooperative credit service. Maximum N.E.C.A. enrollment. Every member using the service. Happiness, confidence and prosperity for all in the glad New Year.

It is not true that the electrical and allied industries need fewer, not more organizations; better, not weaker ones? All branches of the industry and all allied lines in these highly competitive times are charged with the duty of seeing to it that there shall be no competition, duplication, overlapping and waste among their own trade organizations.

Each association, in its own definitely determined sphere, should be so sustained, developed and operated as to render to the trade a needed, specialized and wholly acceptable service, not encroaching upon, rivaling or in conflict with any other legitimate association within the allied electrical industries. And when we write of these allied trades, we refer to all in which electricity enters, in any degree, radio, automotive, fixtures, apparatus, appliances, devices, supplies, etc.

The Department of Commerce has shown the way in helping trade to see itself. Its studies in simplification and standardization are working miracles. Varieties of hotel chinaware, for example, have been reduced from 700 to 160; milk bottles, 49 to 9; bed blankets, 78 to 12; paving brick, 66 to 4, etc. What government has done and is doing in discovering and effecting trade economies, ought to be undertaken and achieved by trade agencies within the industry.

¶ **Trade associations are valuable contributors to America's commercial and industrial progress. Our people's favorable position may be attributed to their accomplishments**

Teamwork, coordination and cooperation among trade organization executives should raise the association dollar to its maximum productive power, thereby winning the whole-hearted support and backing of the allied industries.

Trade associations are making valuable contributions to America's commercial and industrial progress, in fields of scientific and economic research, in statistics, in simplification and standardization of commodities, in promotion of arbitration, in development of national and foreign trade and in a thousand other directions.

The favorable position of our people in the business world rightly may be attributed, in no small degree, to trade association accomplishments. So long as such organizations confine themselves to their major objectives and win success by concentrating upon their prime task and rendering indispensable service, so long will their existence be justified. But when a trade association takes on a new service, one already covered by long established associations, such action seems not in accord with the need of the times.

It is impossible for this article to deal *generally* with the theme of overlapping of trade association activities. The executives of each organization well may study the subject of cutting overhead by avoiding overlapping functions. Each knows best his own problems. Hence we'll stick to our last, and speak *specifically*.

Take the matter of credits. Here is a technical subject. True credit executives now regard themselves as members of a profession. The essential requirements, found in all

professions, are scientific study and disposition to render public service.

No tyro should be allowed to run a credit bureau for a trade association unless he knows more than the rudiments of the undertaking. The protection of the membership against legal traps and pitfalls requires constant alertness of an informed mind.

Operating a credit association is an exacting job. Its service increases in geometrical progression with its membership. Like a telephone system it is supposed to be in operative condition day and night.

A trade association manager who promotes credit bureau activities as an adjunct to the main objectives of his organization is courting trouble, soon or late. Credit is a job by itself. It may not safely be scrambled with un-

¶ Men with foresight and courage laid the foundations for the N.E.C.A., with ample provision for enlargement and improvement in the superstructure as required by changing conditions

related associational operations. There is too much involved and at stake to make it an auxiliary service, or a mere appendage to any organized effort. It is a major activity in itself.

This is not a new position on this subject. It was long and carefully considered and acted upon by leaders in the electrical and allied trades as early as 1895. Their united efforts resulted in forming the National Electrical Credit Association with offices in New York, Boston, Philadelphia, Chicago and San Francisco. Electrical and allied manufacturers and wholesalers of approved standing are eligible for membership. There are over 800 such enrolled.

A generation ago there were manufacturers of electrical apparatus and appliances, whose lines were as distinct from the manufacturers of electrical supplies, as the manufacturer of electrical lighting fixtures is different and separate from the radio manufacturer today. A great many independent telephone manufacturers were strong a generation ago. They were in a class by themselves. And there was then much trade jealousy and suspicion. Yet, every one of them enrolled in the N.E.C.A., as a common clearing house of credit facts.

In the nineties the avenues of distribution were distinctly marked. Today distribution is complex and confusing. Not long ago a man went into one of our modern drug stores and asked for a plow. The druggist said, with regret, he did not carry plows, but that there was an agricultural implement establishment three doors away where plows were sold. Whereupon the prospective, but disgusted customer retorted "You have a FINE drug store, you have."

What does all this mean? Does not the logic of present distribution methods point to the necessity of one central credit medium within the electrical and allied trades and all branches thereof, with which should be lodged all pertinent ledger facts, credit and collection experiences surrounding common customers?

Men of foresight, courage and enthusiasm laid sound and accommodating foundations for the N.E.C.A., with ample provision for enlargement and improvement in the superstructure as required by changing conditions. It has always been in the power of the industry so to shape the system as to have it conform to the needs of each passing year.

During all these years the N.E.C.A. has been officered and maintained by unselfish men in the industry who have given freely of their time, without reward or recompense save the consciousness of making, in their day and generation, a contribution of service for the general good. The association was organized not for pecuniary profit. There are no stockholders, or directors, drawing dividends or extra compensation. Every penny raised by dues is transmuted into service. That service is for the exclusive use of members.

Why then should it be thought necessary for any industry allied in any degree with the electrical, or branches thereof, to set up an independent credit service? Is it not in line with the demands for simplification and standardization to find a common ground for credit interchange? Why go to the added expense of setting up an independent agency, the work of which is bound to be, to a certain degree, a duplicating and overlapping service? All of which further means a wastage of time and money, increasing overhead and worry, receiving in return only incomplete credit service as contrasted with that of the N.E.C.A.

Surely if it is possible to secure among the branches of the allied industries, unity in planning sales promotion campaigns, logically there should follow unity in credit protective policies.

In periods of large, though declining, volume, falling prices, narrowing profits, of costly, if not deadly, competition, trade abuses multiply and thereby losses are compounded. Such losses, in such times, hurt seriously. Often they are disastrous. And 18,671 times this year they have proven destructive of enterprise.

By the very law of its being, the N.E.C.A. is the appointed, proper and pioneer medium to which the allied industries and all branches in every section of our vast country, should commit for consideration and correction credit and collection abuses.

At a time such as this, the N.E.C.A. is the common denominator of the electrical, radio, automotive, fixture, and allied industries, as a matter of economy, should be recognized and utilized as the master key to open to the trade its mutual protective and corrective privileges through "Cooperative Credit Service."

The period is a severe test of business and of business men. But the N.E.C.A. has the man power and the program to weld our associated trade activities, dealing in credit matters, into a unified and harmonious whole.

And if the N.E.C.A. man power and mechanics are not equal to the task, surely the allied industries can meet and master the situation. The industry is the creator of the N.E.C.A. The creator can control and direct its creature.

¶ In the interest of trade economy there should be a union of credit forces managed and operated for the benefit of the allied electrical industries, working through the N.E.C.A.

Is not the time ripe for the erection of an allied industries committee on coordination and cooperation? Possibly there already exists an appropriate and competent agency or commission to undertake this work. Should there not be a survey, study and defining of the objectives and the realm of each trade organization? Then there should be such a coordination of the activities as to enable each legitimately needed organization to be free to accomplish its proper part in the big task, to the best possible advantage of all concerned and at the lowest possible cost.

There ought not be any competition for bad debts. No more should there be competition, overlapping and duplication among the credit agencies of the electrical and allied industries.

The unbusiness-like and inefficient, the unworthy and unscrupulous customers who have stung or swindled the trade in one industry, branch, division or section should not be permitted to play others without notice.

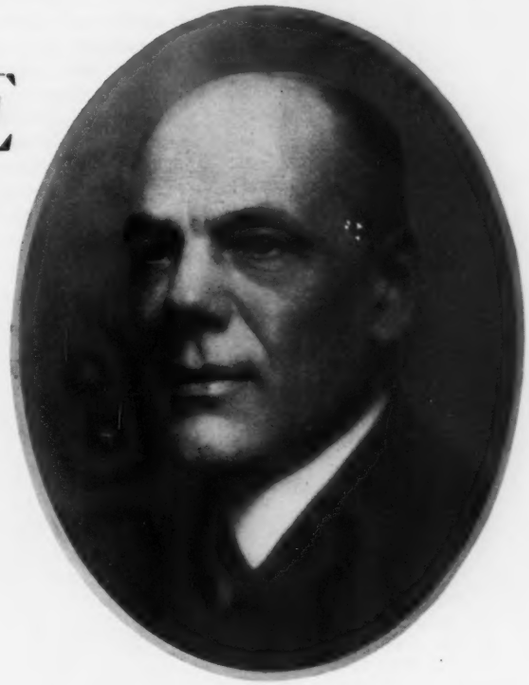
To secure this degree of sales safety there should be a credit union of all manufacturers and wholesalers of the allied trades for mutual guidance and protection. This consummation devoutly to be wished is entirely practical and possible upon enrolling in the N.E.C.A.

Then each N.E.C.A. member would notify the association immediately of credit and collection defaults and delin-

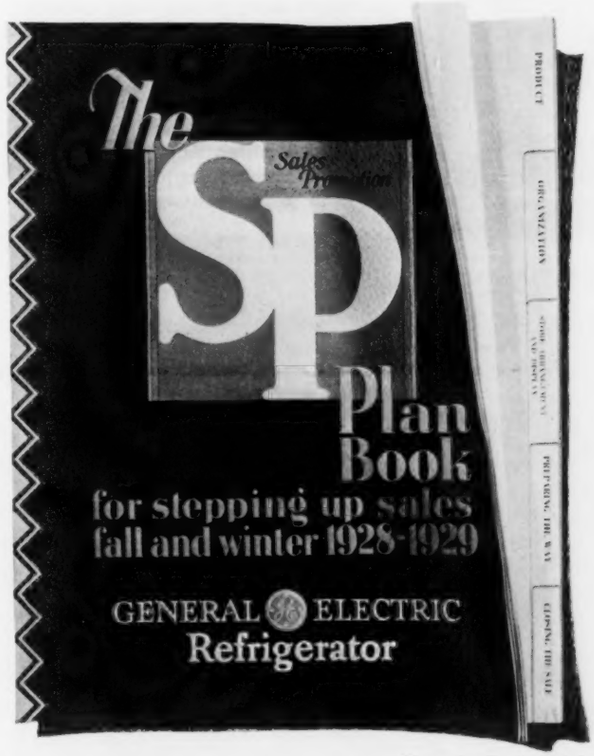
(Continued on page 62)

Coordinated Selling the KEYNOTE of SUCCESS

By E. H. CAMPBELL
Manager, Sales Promotion Department, Rex Cole, Inc.



Rex Cole
President Rex Cole, Inc.
New York Distributors of General Electric Refrigerators



Photos by P. A. Nyholm

A TYPICAL sales promotion plan book, which is a sample of the quality of assistance the General Electric Company affords all distributors. This book outlines sales methods devoted in part to the product, organization, and display

WHILE electric refrigeration enjoys an apparent advantage by virtue of its large potential market, at the same time this very low saturation point constitutes an obstacle to what in the automotive industry would be considered volume sales. Yet the ultimate market for electric refrigerators should very nearly parallel that for motor cars. The public has come to regard the automobile as a necessity. Moreover the large number of motor vehicle owners is in effect a powerful adjunct to the various dealers' sales forces. The assistance which can be expected from electric refrigerator users in promoting sales is as yet comparatively negligible. Nevertheless healthy progress is being made in this direction as is reflected by the increasing number of sales attributable to owner cooperation.

Planning Sales Activities

FOR the present, however, the electric refrigerator merchant must prepare for a definite program of education to buttress the efforts of his field sales force. He must, furthermore, realize that the spread of enlightenment upon the need for proper refrigeration to insure healthful food preservation will react to his benefit whether it results from his own efforts or from those of his competitors. The ice industry has now officially adopted this policy. In other words, by eliminating wasteful and unethical competition public acceptance of electric refrigeration has been greatly strengthened.

But to return to the actual merchandising problem we find the large majority of that part of our market which, by the generally accepted standards can be considered immediate, has yet to realize the many benefits which accrue to the owner of an electric refrigerator. Of the remainder

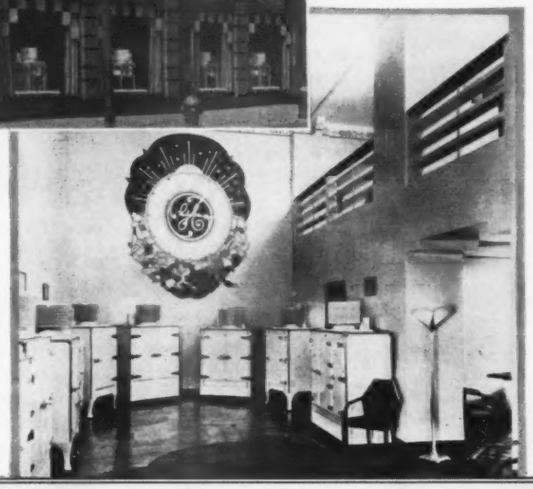
ONE of the nine exclusive metropolitan display rooms. This one at Bond and Livingston streets, Brooklyn, combines billboard effect with splendid identification

relatively few have come to look upon these advantages as necessary. This situation produces the double selling task which confronts the electric refrigerator sales organization. Successful dealers have recognized this and have prepared accordingly.

Such were the conditions which faced the General Electric Company in 1927 and which dictated the formation of a separate department to handle its refrigerator sales activities. The new division was to function independently of other branches of the company so that its energies could be concentrated upon the new industry and so that its merchandising plan could be framed to suit the requirements of that industry alone. The results have abundantly justified this policy. Distributors and dealers throughout the country were selected in pursuance of the same policy.

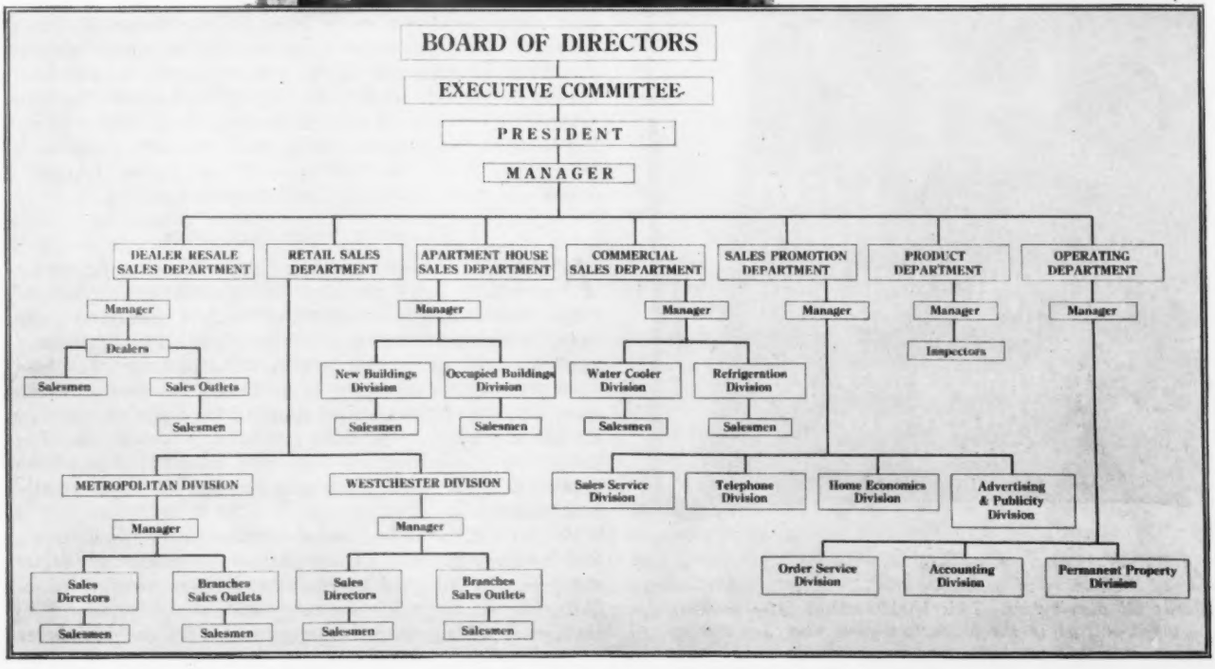
Advertising, sales promotion, and selling methods were worked out to meet the needs of a market comparatively little versed in the necessity for refrigeration, let alone for proper food preservation. Assistance in these activities is available to the distributor, dealer, and salesman so that a unified program combining proper proportions of these facilities may support the General Electric Refrigerator campaign.

Rex Cole, Inc., distributor for Greater New York, Nassau, Suffolk, Westchester, Rockland, Orange, and Putnam Counties in New York State, and Fairfield County, Conn., is probably as highly developed a distributor organization as exists. Its activities are thoroughly departmentalized to the end that each field may enjoy skilled and undivided attention. For example, the sales organization comprises departments devoting themselves exclusively to sales through dealers, to apartment house sales, to retail household sales and to commercial sales. In the city where the population is dense, well situated and attractively appointed distributor display rooms are devoted exclusively to sales of these refrigerators. In the remainder of the territory where the market would not support a dealer selling only electric refrigerators, dealers handling allied but non-competing lines afford coverage much more intensive than another system would permit.



THE show room at 7 East 45th street, New York City, built about a modern motif, typifies the modernism of the product. The chart below indicates the internal mechanism of Rex Cole, Inc., distributors of G-E refrigerators

Selling the commercial prospect, the apartment house prospect and architect, and the housewife each requires different training and salesmen of particular aptitude for the respective task. Frequently a salesman highly successful in the household field would not possess the right qualifications for apartment house work and so on. The specialization sales policy of assignment of each



salesman to the field for which he is best suited permits the salesman so assigned to develop his talents in the most favorable conditions. Greater individual productivity on the part of the sales force and greater combined volume are the results of this policy.

As far as possible that part of the selling task which deals with giving the market a proper understanding of the reasons for better refrigeration is performed through advertising and sales promotion. The purpose of this is to furnish to the salesman a market sufficiently aroused to the need to allow him to concentrate his efforts upon convincing prospects of the merit of the product he offers. The basic requirements of the educational program are first that the amount of money spent must bear a justifiable relation to the volume of sales and secondly that such expenditure must be apportioned among the several activities comprised so that a well coordinated plan may result.

The local newspaper advertising campaign is carefully planned to tie-in with the theme underlying copy used in the national magazine campaign and is synchronized to produce a maximum effect. Special events or accomplishments applying to Rex Cole, Inc., are capitalized upon in our newspaper campaign to supplement the national program. Institutional copy selling the need of better food preservation was employed quite generally in national and local publications during 1928. It has performed an invaluable service in expanding the immediate market. It ranks high among the better advertising campaigns in point of layout, copy, timing, and development of the thought back of it.

Our sales promotional program supplements this advertising by uncovering prospects who have progressed to the "interested" stage and by concentrating the educational effect upon this fertile soil. Direct mail primarily, as made available by Walter J. Daily, manager, Sales Promotion Division, Electric Refrigeration Department of General Electric Company, forms one of the mainstays of this work. It operates in conjunction with and in support of the salesman's task in the field. It goes far on the road to crystallize "interest" into a desire to purchase. Its messages are adjusted to the season and are designed to bring home to the interested prospect arguments on every conceivable phase of the subject. Special localized campaigns are also employed.

(*Continued on page 62*)

GENERAL ELECTRIC
Refrigerator
chosen for six new
Tishman Apartment Ho

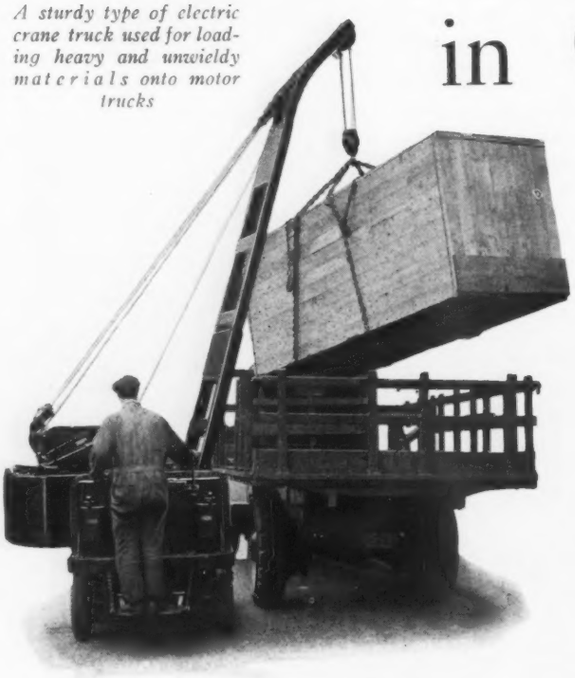
Mr. Tishman says: "What we wanted was the best. We chose the General Electric Refrigerator only after an exhaustive investigation which convinced us that it stands in a class by itself."

REX COLE INC.

ABOVE is an illuminated, colored glass window at the East 45th street showroom. On the left is a newspaper clipping, typifying Rex Cole advertising copy. Below is the modern kitchen at the Brooklyn display room

Proper Maintenance in Materials

A sturdy type of electric crane truck used for loading heavy and unwieldy materials onto motor trucks



The possibility of long preciation are dependent and a few simple rules of

By C. B. Crockett

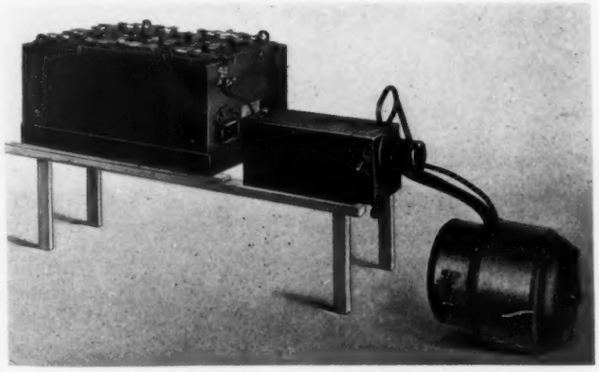
The Society for Electrical Development, Inc.

CHIEF among the characteristics of electrical equipment in general may be listed dependability. The power itself tends to create in the design of any electrical machine a minimum of moving parts, little or no variation in stress or temperature and reduces the chances of mechanical failure or improper adjustment. The dependability of the electric motor is proverbial and yet there are probably a few simple rules of maintenance which the motor manufacturer would like to see more universally followed. Why is it that every manufacturer, even those engaged in the production of similar equipment, seems to demand as his inalienable right that *his* equipment be given the most careful attention and the most exacting care when he himself is half the time guilty of graver abuse of the equipment in his own plant? I believe that in most cases it is because the failure of his equipment through improper maintenance comes to him from his customers whereas his subordinates in his own plant would be unwilling to admit slip-shod maintenance in caring for shop equipment. The wise plant executive not only lays down adequate rules for plant maintenance, but also checks periodically to see that these rules are carried out.

Probably the storage battery industrial truck requires as little maintenance as any piece of electrical equipment (the electro-magnet excepted) and is therefore treated with corresponding indifference and lack of attention. The very simplicity of the equipment—a battery, a motor, a set of driving gears and a controller—makes the task a simple one as compared with a gasoline engine or an automatic lathe. But even a motor or a set of gears won't perform indefinitely without fresh grease or oil, controller fingers do wear especially when repeated over-loads are applied and a storage battery to maintain its original high efficiency requires that the few rules suggested by the manufacturers be followed and that a periodic inspection be made.

The possibility of long life and a low rate of depreciation are dependent on regular though slight inspection. The Packard Motor Car Corporation employs a fleet of over 65 industrial trucks, 35 of which were bought prior to 1918. Over half their fleet has been in service over ten years and the new trucks have in almost every instance been purchased as additional equipment to meet the increasing demands of the plant. Trucks and batteries are regularly inspected, records are kept of charging and testing batteries, and each truck has a separate repair and inspection record. This care is reflected in the cost as $50 per month takes care of the truck and 6c. to 8c. per hour the battery.

Before discussing proper methods for maintaining this equipment it might be well to outline briefly what maintenance includes and give actual examples of the cost of such service in plants where trucks are kept in good condition and perform satisfactorily the heavy tasks placed on them. Maintenance of the truck itself consists in a periodic inspection, cleaning and greasing, the taking up of brakes and bearings and the replacement of worn or burned out tips on the controller. Care of the battery includes proper charging, testing, flushing, cleaning and maintenance of the electrolyte at proper level and strength.



The three simple essentials of the electric truck—battery, controller, and motor. Smooth power depends upon proper charging, cleanliness, and electrolyte maintenance of the storage battery

Importance of Equipment Handling

life and a low rate of depreciation upon regular inspection, equipment maintenance

An electric truck in service at the Atwater Kent Manufacturing Co. Note the clean, well-kept appearance of the equipment, realized by periodic inspection, cleaning and greasing, taking up of brakes and bearings, and replacement of worn or burned-out controller tips

One plant handling sheet metal for stampings kept a record of costs over a period of 6 years. The trucks were in 24 hour service and handled an average of 17,708 tons per year exclusive of rehandling which would more than double the actual weights transported. The average haul was 200 to 300 feet and loads were consistently 50 per cent over the rated capacity. The repair cost is recorded as 6 cents to 7 cents per day per truck.

Another plant keeping careful records found that, with the trucks handling 19,866 tons per year, the costs were:

Power	$379.10
Labor for charging	174.22
Flush oil and grease	82.03
Repair labor	97.84
Repair material	54.48
Total operating cost:	$787.67

The fixed charges on this installation were $457 making the total cost $1,244.67 while gross savings were $3,280.67 allowing a net savings of $2,036 or the first cost saved in one year.

At a plant handling copper billets the maintenance cost was found to be $21 to $27 per 1,000,000 pounds moved.

At another location 12 tractors are employed and a monthly report shows the following costs:

Total days of operation	338
Total hours of operation	2496
Maintenance labor	$303.68
Maintenance material	17.90
Power (4734 kwh. at 5 cents kwh.)	230.95
Total cost	$552.53
Cost per truck per month	$42.50
Cost per truck per day	1.63

In a plant operating 4 trucks the spare parts and lubrication cost only $75 per truck per year, while the mechanic's time for inspection amounted to $100.

The engineers at the Hawthorne plant of the Western Electric Co. find from their records that total costs of electric industrial trucks are from 50 cents to 55 cents per hr. This, however, includes 25 cents per hr. for depreciation as they have an arbitrary method of charging off equipment in four years. The actual life they say is nearer 10.

To obtain records similar to the above only requires the regular adherence to a few simple rules. The reasons for such attention as is suggested is in almost every case obvious at a glance and in few cases could a better example be found of that bromide concerning the relative economic value of "an ounce of prevention" and "a pound of cure."

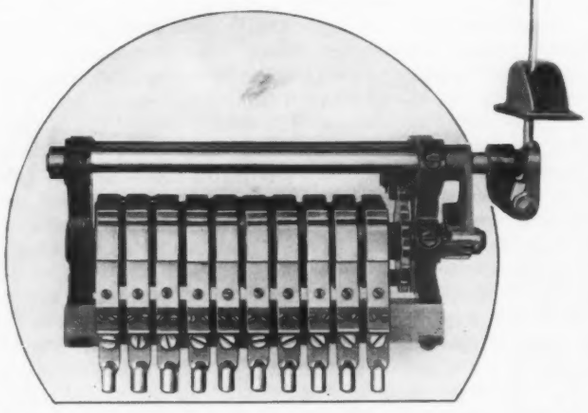
Maintenance of electric industrial equipment divides itself into two general classes—that necessary for the truck and that required by the battery. Omission of the first may not have serious consequences until considerable time has elapsed but improper care or abuse of storage batteries will definitely lessen the efficiency of the power supply and both if continued long enough will finally result in damage that will be expensive in correcting. It is sometimes unwise to describe the abuse which equipment has withstood but one instance is quoted herewith lest it be assumed that industrial trucks and storage batteries resemble a watch or a pair of chemist's measuring balances as regards rough treatment. The author was privileged to witness the satisfactory operation of an industrial truck 14 years old, whose machinery was completely hidden by dirt, on which hardly a speck of paint remained, whose chain drive was almost completely dry and on whose battery it was difficult to even locate the terminals of the individual cells due to the accumulation of years. The battery had been in service 10 per cent longer than the guarantee, had been refilled with water from the city tap and had been charged in an anti-

quated manner not recommended by the manufacturer. The performance of this truck and battery was certainly in spite of, rather than because of, the treatment which it had received.

Considering the necessary maintenance for the industrial truck it might well be summed up as the care you would give a motor truck with the elimination of all work on the engine, magneto, transmission and clutch. Such problems as carbon removal, valve grinding and setting, spark plug setting, carburetor adjustments, clutch relining, etc., have been eliminated. The little that remains is the cleaning, oiling, greasing, the adjustment of brakes, the tightening of main bearings, and the inspection and replacement of worn fingers on the electric controller. Plants operating a number of trucks find it advisable to have a special room where trucks are stored, inspected and maintained. Generally Saturday afternoon is used to clean, grease and inspect the trucks and operators should be educated to take pride in their equipment. Trucks are so designed that parts are accessible for inspection by the removal of cover plates, and are generally equipped with pressure greasing devices which permit forcing out the old grease with its accumulation of dirt and waste. Where the splash system is employed the oil level should be carefully maintained, as incomplete lubrication or wasted oil will result from too low or too high a level respectively. Lifting and steering mechanism should be regularly inspected, cleaned and any slack taken up when it becomes apparent. By the removal of covers the motor commutators and brushes can be inspected. Overloads should be placed periodically on the equipment to see that brushes are in adjustment and excessive sparking is not taking place.

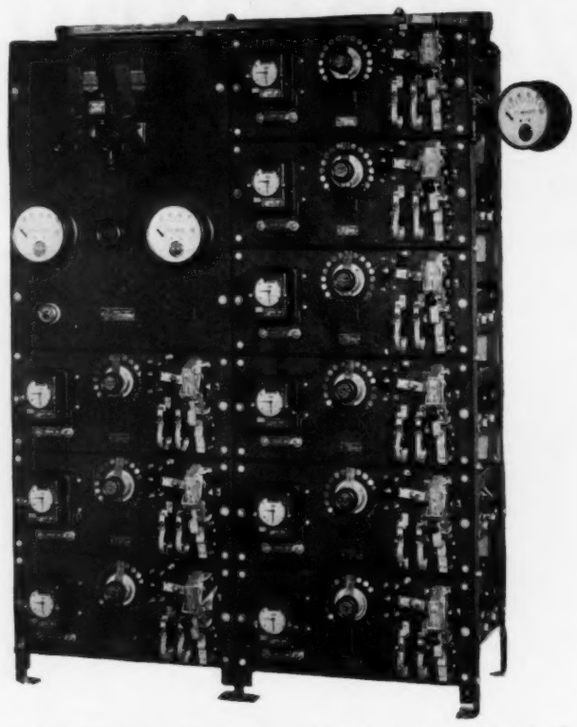
Storage batteries fall into two main divisions—the lead-acid type and the nickel-alkaline. Both types perform faithfully with a minimum amount of attention and both suffer from certain abuses. The three main points which if attended to will make the storage battery a powerful and dependable source of smooth power are first proper charging, second cleanliness, third maintenance of the electrolyte at proper height and density. Proper charging includes both the regular daily charge and an "equalizing" charge which should be given at least once a week. This equalizing charge consists in continuing the charge for one or two hours at the finishing rate. The charge should be continued until all cells are gassing freely and (in the case of the lead batteries) the specific gravity of the electrolyte shows no appreciable change. If the battery is only charged infrequently (less than once a week) every charge should be made an "equalizing" charge.

Probably no investment will yield greater dollars and cents return than that invested in modern automatic charging equipment. This equipment is designed to mechanically regulate the rate of charge, to cut off each battery when fully charged and to stop the motor generator when the last battery has been finished. If, for some reason, the current supply is cut off the circuits to each battery are opened so that no reverse flow can occur; the circuits are again automatically closed when the power is again available.



The type of controller found in many electrical trucks. Neglect of truck will not have any serious consequences until considerable time has elapsed, but it is wiser to maintain regular inspections

Next in importance is the maintenance of the electrolyte at proper height and concentration. It should be understood that the action of the battery never will weaken a solution and only water is passed off in gassing or by evaporation. Thus it is apparent that with only occasional exceptions the battery needs only water to bring the level of the electrolyte to the proper level specified by the manufacturer. Unless the plates are properly covered by the electrolyte deterioration of the exposed part will ensue and, of course, the effective area of the plates is cut down with a resulting decrease in the capacity. The content of the electrolyte is secured by hydrometer readings and caution should be given not to take such readings either during the charge or directly after the addition of water, as in the first case the gas bubbles will produce an error in the reading while sufficient time has not been allowed in the second for the water and electrolyte to form uniform mixture throughout the cell. The use of other than distilled water will materially decrease the life and efficiency of a battery as the impurities are left in the bottom of the cell as the water is driven off and while one or two times may do no harm the cumulative effect is bound to be seriously injurious.



A nine circuit charging panel used by the General Electric Co. This equipment mechanically regulates the rate of charge, cuts off each battery when fully charged, and stops the motor generator when the last battery has been finished

The last point in connection with care of the battery is that of cleanliness and proper ventilation. Both lead and steel alkaline batteries should have the outside clean and dry and then covered with a thin coating of vaseline. Adequate opportunity for ventilation should be provided so that the temperature during both charge and discharge

(*Continued on page 62*)

The Business Outlook for 1929

A review of the activities of the electrical industry in 1928 with forecasts for the coming year, as taken from the predictions of men prominent in the electrical, industrial and commercial business world

"THE electrical manufacturing business for 1928 as a whole has been quite satisfactory, with an increase in volume of about 7 per cent. It is remarkable that the use of electrical current in the homes and in the factories continues its high rate of increase from year to year. The 1928 rate of increase is about 8 per cent, and is becoming one of the best indices of general and industrial conditions in America. Basic economic conditions are sound, inventories are not unduly expanded, credits and collections are satisfactory, earnings of labor are high and employment steady, all of which presage a favorable outlook for 1929."

GERARD SWOPE
President, General Electric Company

"DURING 1928 the electrical industry continued that steady growth which has characterized it for the past twenty years, with the exception of a brief period following the war. The consumption of electrical power increased about ten per cent, and there was a corresponding gain in the production of electrical apparatus. Prospects for the coming year are very encouraging, as there is no indication of a reduction in the rate of general electric progress, and there is every reason to believe that the demand for electrical apparatus for railroad electrification, marine equipment and other applications will be materially increased."

E. M. HERR
President, Westinghouse Electric & Mfg. Company

"ANOTHER year of new attainments by the electric power and light industry has been written into the history of American industrial accomplishment with the passing of 1928," says Pynchon & Company, well known investment bankers of New York City.

"While several months must elapse before final figures are compiled sufficient data are at hand to warrant the statement that in its financial and operating activities this particular group of the public utility industry has created another set of new high records."

"Continued expansion of facilities by the electric light and power industry and a greater distribution of its service to all classes of consumers was a feature of public utility operation in 1928," says Preston S. Arkwright, president of the National Electric Light Association.

"The amount of electrical construction contracted for in 1928 was greater than in 1927 by more than 10 per cent," reports L. K. Comstock, chairman of the board of L. K. Comstock & Company, Inc., "Construction contracted for in 1927 was greater by about eleven per cent than for 1926 which was the record for all time until that year. There seems to be no valid reason within sight for any material diminution in the volume for 1929; but rather an increase."

"Contemplated replacements of obsolete and inefficient installations, the large building program promised for the immediate future and a general desire for efficient, scientific lighting, lead me to believe that 1929 will be even more prosperous than the preceding year," is the prediction of Leopold Plaut, of the Black & Boyd Manufacturing Company.

THE year 1928 exceeded all previous years in the volume of production of electrical equipment. The dollar value of the total electric product was also increased during 1928, in spite of the fact that, because of numerous improvements in manufacturing methods, it was possible to effect reductions in the prices of certain classes of apparatus and equipment.

JOHN LISTON
—In the *General Electric Review*

James W. Garside, president of the DeForest Radio Company and the Jenkins Television Corporation, says, "We enter 1929 with every assurance for a continuation of the prosperity our industry has enjoyed during the past twelve months. A firm foundation has been laid for future progress. I look forward to improvements in vacuum tubes during the next twelve months and I expect to see the dawn of practical television in the home, with inexpensive televisors and a comprehensive nation-wide television service. I also anticipate refinements and improvements in the 1929 offerings of radio manufacturers, but nothing so radical as to upset our well-established fundamentals."

"Graybar products are sold to a wide variety of industries and our sales budgets should, if they have any validity, reflect the trends of general business," says G. E. Cullinan, vice-president of the Graybar Electric Company, Inc. "When we say, therefore, that our 1929 sales budgets indicate an appreciable increase in business—that is a definite index of our business for 1929."

The Franklin for Good

A discussion of the purpose of the Franklin Specification with an outline of the information contained in the different tables

BETTER lighting for the interiors of commercial, industrial and public buildings is more than a matter of simply installing a few lights here and there by mere guesswork. It is rather a problem involving careful consideration if best results are to be obtained, and to combine effective lighting with economical operation requires a study of conditions peculiar to the building, the uses for which it is intended and its equipment, by specialists trained to adapt general and good lighting practices to specific needs. But, until recent years there existed considerable difference of opinion among lighting experts as to just what constituted good lighting for such purposes.

Now there appears to be some very well defined ideas on the subject, derived from long study and research. It is clearly evident that a building intended for the fabrication of rough products, and lighted accordingly, would not serve for the manufacture of fine machine parts or the making of some of the more delicate textiles. And in a like manner, neither would a room intended for sales purposes with suitable lighting serve well as an office or drafting room. In public buildings the rooms are used for different purposes and for this reason different sections or rooms require decidedly different lighting conditions, whereas in the past all of them were illuminated in a like manner.

THE Franklin Specification is the work of a special committee of lighting specialists, manufacturers of lighting equipment and others of high rank in lighting practice. This committee was formed by The Society for Electrical Development and through its work a similar specification that had met with favor in the Chicago district was rearranged so that it could be applied nationally to afford better and effective lighting in all kinds and types of commercial, industrial and public buildings.

THE EDITOR

Realizing that these things were true some years ago lighting experts, manufacturers of lighting equipment and others set about to find a solution to the problem. One result of such experiment and research was the compilation of a set of lighting rules, formulas and data first applied in Chicago. So well did they serve the purpose for which they were intended that they were adopted by The Electric Association of Chicago. In a few years the results of their application attracted the attention of other lighting experts and they conceived the idea that these rules, slightly modified, might be made to apply nationally. As a result a special committee, made up of lighting experts manufacturers of lighting equipment, and other authorities of high rank in lighting practice, was formed by the Society for Electrical Development. This committee took the specifications that were in use in Chicago, studied them thoroughly and finally devised a set of rules, formula, data and other information and collated it into what is now termed the Franklin Specification.

This Specification provides essentially a simplified method for determining proper outlet spacing, lamp size, type and kind of equipment and the proper mounting height for lighting units in all types and kinds of industrial, commercial and business buildings. Primarily the Franklin Specification, as it has been collated by the special committee of the Society for Electrical Development, is applicable nationally and represents a solution of the essential factors of lighting, including standards of illumination for most industries and classes of business.

In addition, the specification provides another service in certain communities, through the local electric company or the local industrial organization, and operated under license from the Society for Electrical Development. Under this additional service completed lighting installations are inspected by qualified specialists, and if found in conformity with the specification requirements a Franklin Red Seal Certificate is awarded. Similarly, Franklin Red Seal Certificates are awarded for layouts of lighting installations which conform to the specification requirements. Likewise, Franklin Red Seal installations must be made in strict accordance with the rules of the National Electric Code of the local electric company and at the same time the installations must comply with all local ordinances. At this time, however, only the specifications are available and the work of getting out the seals and certificates is well under way.

In its entirety the Franklin Specification includes but little information or data that is not known to those having to do with lighting installations, but what data it does contain is well collated and so clearly explained that its application to any lighting problem is simplicity itself. The specification is essentially divided into five parts. One of these is devoted to an explanation of the application of the specification. Three sections contain information and data relating to lighting intensities, room and maintenance conditions and methods for determining lamp sizes, outlet spacing, and recommended distances from the bottom of the lighting unit to the floor with various types of

SPECIFICATION LIGHTING

of Commercial, Industrial and Public Buildings

lighting equipment. Still another section is devoted to a discussion on adequate wiring in which it is pointed out that consideration should be given to providing adequate wiring so that should such conditions arise the wiring capacity per outlet could be increased to meet changing conditions. In order to provide for this the fifth section of the specification gives suggested minimum wiring capacities for various types of buildings and at the same time provides a table of wire sizes for lighting outlets.

In Table I, "Lighting Intensities," there are listed 104 industries or classes of business and each of these classes is again divided into many subheads to include almost every type or kind of business or industry. Besides this information Table I contains the recommended foot-candles of illumination necessary to the adequate lighting of a building for these various types of industry or business, together with the minimum number that are required. As an example, under the heading "Aisles, Stairways and Passageways" the Franklin Specification recommends that there be three foot-candles of illumination, but offers as an optional installation a minimum of not less than two. In this manner the specification is very flexible throughout, for if in making the installation it is desired to obtain the best illumination the foot-candle requirements recommended can be installed or the minimum may be used.

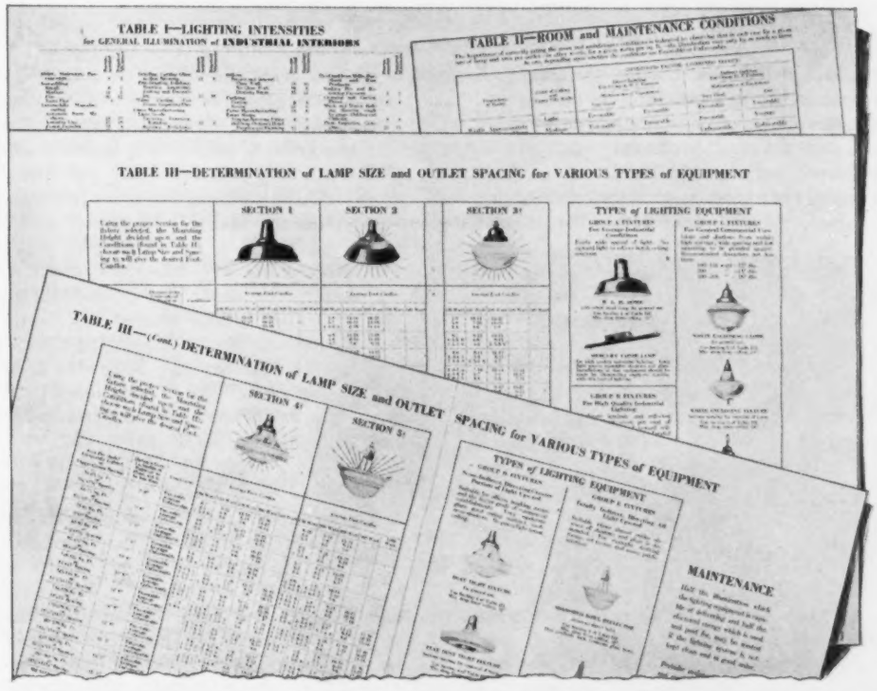


TABLE I—LIGHTING INTENSITIES
for GENERAL ILLUMINATION of INDUSTRIAL INTERIORS
TABLE II—ROOM and MAINTENANCE CONDITIONS
TABLE III—DETERMINATION of LAMP SIZE and OUTLET SPACING for VARIOUS TYPES of EQUIPMENT
SECTION 1
SECTION 2
SECTION 3
TYPES of LIGHTING EQUIPMENT
TABLE III—(Cont.) DETERMINATION of LAMP SIZE and OUTLET SPACING for VARIOUS TYPES of EQUIPMENT
SECTION 4
SECTION 5
TYPES of LIGHTING EQUIPMENT
MAINTENANCE

The illustration above shows clippings taken from the Franklin Specification merely to indicate the nature of its contents and the arrangement of the different tables and types of lights

Table II deals with the room and maintenance conditions. This has to do with the importance of rating the room by observing in each case for a given size or unit and area per outlet that the desired illumination may vary as much as three to one, depending upon whether conditions are favorable of unfavorable. By the latter it is intended that those planning the installation must observe the proportions of the room, with reference to length, width and height, as well as the color of the walls and ceiling and whether the room is to be illuminated by direct or indirect light, as all of these conditions have a bearing on the results of the installation.

Table III is probably one of the most useful in the specification for it has to do with using the proper section for the fixture selected, the mounting height from the lower edge of the fixture to the floor, as it applies to the conditions pointed out in Table II, and the average foot-candles to be obtained from the different types of lighting units when they are mounted and spaced under many different conditions. Accompanying this table are five typical illustrations of recommend types of lighting equipment. With each of these is complete information as to its characteristics, with specific instructions for its installation to obtain the results most desired. In this section too is some useful information treating of maintenance in which it is pointed out that much of the illumination might be lost if provisions for proper care were not made.

Extensive Facilities of I-T-E Circuit

The plant of the I-T-E Circuit Breaker Company at Nineteenth and Hamilton Streets in Philadelphia, Pa.

A general description of the plant and methods of the I-T-E Circuit Breaker Company of Philadelphia, Pa., in which are manufactured I-T-E circuit breakers and switches

By William W. Baxter
Associate Editor
Electrical Manufacturing

PROTECTIVE devices for use with electric circuits have been known and used since the earliest applications of electricity as a source of power. They have been of many different types but the first probably, was the simple fuse. Even these were very reliable and in them were embodied many of the characteristics of the present-day protective device. In fact, so well did fuses serve the purpose for which they were intended that they are by no means obsolete, even today. But, as electrical systems continued to grow the costs of maintenance and replacements, delays in the restoration of service and safety became factors making necessary the use of better protective devices than fuses. As a result, this demand eventually led to the development of automatic switches of different kinds and these in turn were the forerunners of the present circuit breaker, a device constructed primarily to disconnect an electric circuit should there arise a condition causing excessive current, low voltage or any other such abnormality.

Cutter's First Circuit Breaker

TODAY the production of circuit breakers of one kind or another is one of the major branches of the electrical manufacturing business. Such devices are now used extensively in industry and commerce to the value of millions of dollars annually, as a means for controlling electric circuits, as a safety measure for protecting life and property from injury or damage and to eliminate fire hazards.

One of the first of the manufacturers of circuit breakers in this country was the late Henry B. Cutter, founder of the present I-T-E Circuit Breaker Company of Philadelphia (formerly the Cutter Company), makers of the generally well-known I-T-E circuit breakers and U-Re-Lites. Henry Cutter was, in his early life an electrical contractor, engaged in commercial and industrial wiring and electrical installations, until an associate, whose name was Stanley, developed a flush-type wall switch. From that time Cutter and Stanley continued the general contracting business and in addition they set about to manufacture, sell and install the Stanley wall switch. As the demand for these increased the contracting business was gradually discontinued and a small manufacturing enterprise was set up in its stead. This continued for a time until Henry B. Cutter, realizing the need for such a device, conceived and developed the first I-T-E circuit breaker, after which he disposed of the switch manufacturing business to devote his entire time to developing and perfecting his first device. This was more than forty years ago and served as the foundation of the present business, which was established in 1888 and incorporated in 1892.

Details of the Factory

IN its plant at the corner of 19th and Hamilton Streets in Philadelphia, the I-T-E Circuit Breaker Company occupies a large industrial manufacturing building, which is shown in one of the accompanying illustrations. When the organization was first formed one floor of this building would have been more than sufficient for the entire production of the company. However, from time to time ever-increasing demands for I-T-E circuit breakers made the acquisition of additional floor space necessary, and so, floor by floor the entire building was occupied. Even this did not afford sufficient space to accommodate ever-increasing demands for I-T-E products so that now there is a four-story addition at the rear of the original plant, entirely devoted to the manufacturing of circuit breakers.

As the building is now arranged the basement serves for the storage of raw materials; the first floor is used for

NEEDED *for* MAKING *Breakers*

grinding, polishing, plating and lacquering operations; the second floor is equipped with manufacturing machinery of many different kinds, and the third floor is taken up by the finished parts stores and the assembling, testing and calibrating operations, while the fourth floor contains the offices, drafting room, slate finishing department and several of the more minor production operations.

In the basement, stored in racks and bins, are to be found all kinds of materials used in the construction of circuit breakers. These include copper, brass and steel, in bars and tubing; sheet metal, wire and several kinds of insulation. Most of the materials are purchased in bars or sheets and these in turn are cut into smaller pieces, in the basement, each of a size suitable for making the part for which they are intended. Each bin or rack is marked with the size and weight of each separate piece of stock material. So, in taking inventory it is a simple matter to count the number of pieces, record their size and the total weight of all material of a kind in stock can be easily calculated from the weight of the bar, marked on the bin. Accurate records of all materials in the basement are maintained by the man in charge of that department and duplicates of them are on file in the purchasing department.

The I-T-E company does not at any time attempt to carry large stocks of materials in storage, but there is always sufficient on hand for at least sixty days' requirements. Of course, with some materials, when economies are to be realized, these are purchased in larger quantities.

In the way of equipment for handling materials there is not much required. All of the parts, except the slate panels are comparatively light. However, the entire plant is equipped with overhead monorail carriers while freight elevators at advantageous points serve for communication and the transportation of materials between the different floors.

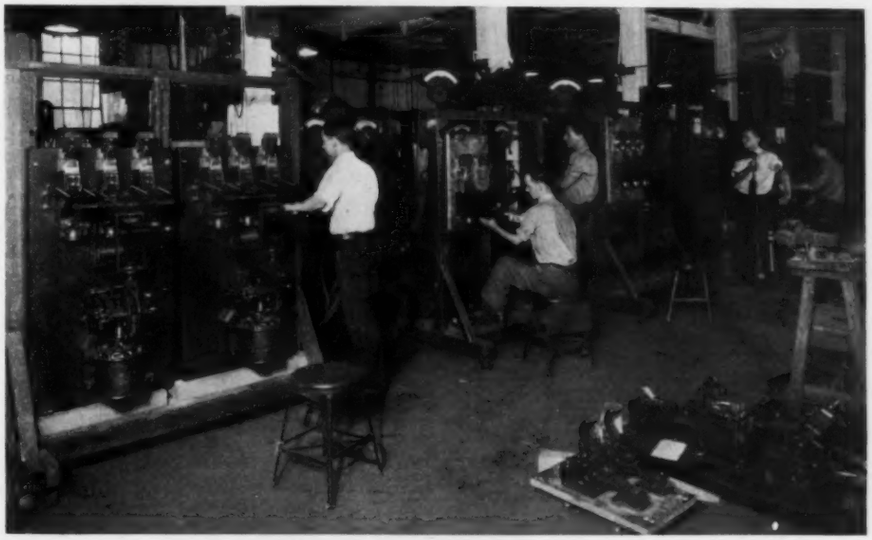
In the manufacturing departments of the plant all of the many different types of equipment are arranged in groups. One section is devoted to the making of screw machine parts, another to punching, stamping and sheet metal forming operations; one to lathe work; one to practically all operations on copper parts, with several others to suit the needs for making the many different parts entering into the building of the two kinds of circuit breakers.

Each of these different sections functions entirely separate from the others. Some of them make special parts, others operate on stock or standard parts and some of them work on both standard and special pieces. This is because of some of the rather unusual conditions under which circuit breakers are produced. Such conditions can be better understood when it is known, for example, that this company can make upwards of one and one-half million different types of circuit breakers, and all of them from some 6000 parts. For this reason it is not their practice to assemble and carry in stock any complete circuit breakers, except on direct order for them. Instead, the company maintains what is termed the finished parts store room. Here are kept sixty tons of stock parts, or rather standard parts, for every type of circuit breaker the company makes. As orders are received these parts are withdrawn from the finished stores and assembled. Any parts not of standard design are ordered directly from the different production departments and eventually all of them find their way to the assembly department, where they are assembled, tested and calibrated.

Special Tools Required

ACCURATE records are kept in the finished parts stores, with duplicates of them in the purchasing department. As parts are withdrawn orders are automatically issued for their replacement. Thus it is that there are always on hand in the finished stores sufficient standard parts to accommodate average demands for thirty to sixty days. As orders are issued for the replacement of standard parts purchase orders are also issued for additional raw materials.

Since the production of many of the different circuit breaker parts requires extreme accuracy there is a need for



A view in the assembly department of the I-T-E Circuit Breaker Company plant at Philadelphia. These operators are engaged at testing and calibrating the assembled circuit breakers. This is a very particular operation and it is the practice of this company to test all breakers under actual operating conditions before they are permitted to leave the plant for service

a large number of special tools, punches, dies and other similar equipment. In the I-T-E plant these are stored in a vault when not in use. Each tool or device is carefully marked with a number corresponding to that of the circuit breaker part it is designed to produce. In addition it bears a serial letter to denote the specific operation it is intended for in the sequence of manufacturing operations. That is, assuming the tool to be a punch and die, if the operation for which it is intended is the second in the sequence of operations the punch and die, in addition to the tool number, would carry the letter B. With such a method as this all operations are performed in their proper sequence.

As this company makes and maintains all of its special tools it must operate a tool department. This is adequately equipped for this purpose and is located in the machine shop section of the plant, conveniently near the tool storage vault.

Production Planning Methods

IT should be understood too that this company does not have what is generally known in other manufacturing plants as a planning or production department. Of course there is general supervision and general planning in a way, but in most cases the foremen of the various departments plan their own work. This arrangement is made possible by the fact that most of the foremen and many of the workmen in the shop have been employed at this work in the plant for long periods of time. They are thoroughly familiar with their respective duties and are therefore qualified in every way to plan their own work. Some of these men have been employees of the company for as long as thirty years and in several instances there are two generations of the same family in the shop.

Since finish and appearance play an important part in the sale of any manufactured article today the I-T-E company operates a very complete and adequately equipped finishing department. This section occupies almost all of the first floor. In it, along one wall, is a row of grinding and polishing machines. In another section is the plating equipment, while still a third department, entirely separated from the others because of fire hazards, is used for painting and lacquering. Both the spraying and dipping methods are used, depending on the finish desired. In this section too are the ovens for baking the finished pieces.

On the third floor of the building is the finished parts stores and the assembly department. The storeroom is of the conventional type, equipped with rows of metal shelving and bins for the storage of the many different parts. As these are withdrawn from stock they are placed in large trays or boxes and in each tray is a duplicate of the order to be filled with a list of all parts required. These trays are delivered to the assembly department where the circuit breakers are put together. Some of this work is done on benches and other operations are performed on specially designed racks. Some of these are stationary while others may be tilted to most any position convenient for the operator. Once a circuit breaker is completely assembled it is very carefully inspected for defects and its operation is fully tested. Should there be any defects or adjustments necessary it is the practice to have the workman who assembled the breaker make such adjustments. In this manner every man engaged at assembly work is thoroughly trained in the exacting requirements of circuit breaker construction. He learns the inherent characteristics of circuit breakers and so in the course of his work can strive to eliminate or prevent many possible and undesirable conditions.

After the breaker has been completely assembled and tested it is calibrated for such conditions as excessive current or low voltage or any other conditions, depending on the purpose for which the breaker is intended. Adequate equipment is available in the calibrating section for testing circuit breakers under any conditions they could meet in actual service. Ordinarily the assembled breakers are mounted on suitable racks, near the calibrating equipment. The calibrating markings are scribed lightly on the proper dials, after which the dials are removed and the markings are engraved on the dials, insuring accuracy and permanency.

The Slate Department

SINCE most circuit breakers are mounted on slate the I-T-E company has, on the fourth floor of its plant, a department fully equipped for cutting, drilling and otherwise preparing the various types of slate panels. In this department are such machines as saws and drills and other machines necessary for this work. Adjacent to the slate department is another smaller section fully equipped for the making of such coils as are used in circuit breaker construction.

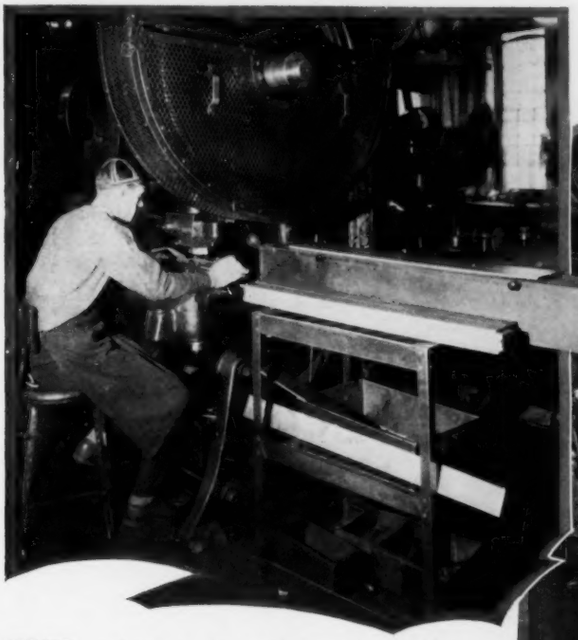
Practically all of the recent addition at the rear of the plant is devoted to the production and assembling of U-Re-Lites, except for one floor which is known as the copper department. In it practically all copper parts are produced.

(Continued on page 62)

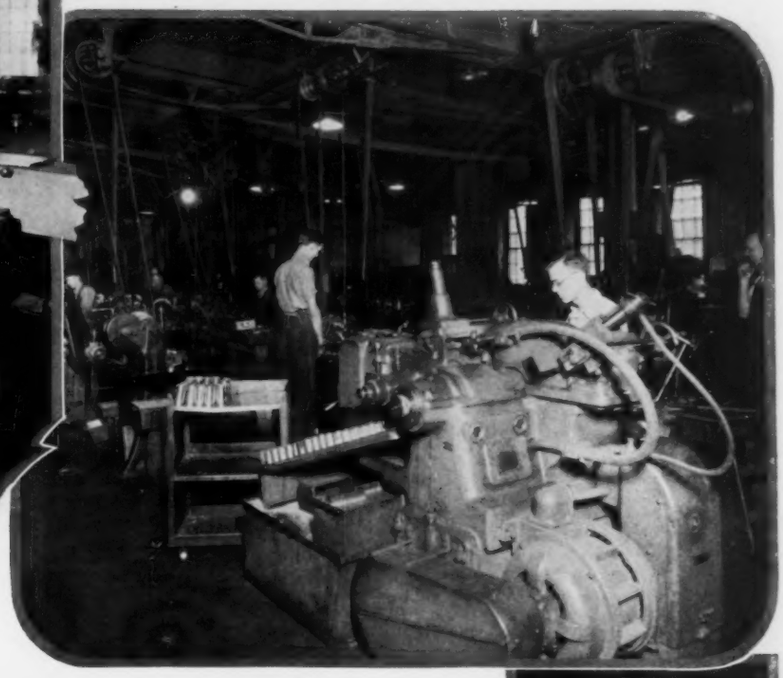
Still further data relative to the production of I-T-E devices with views taken in the plant may be found on the three following pages.

More than sixty tons of finished parts are always carried in stock in this department of the I-T-E Circuit Breaker Company. From them can be assembled over one and one-half million different kinds of circuit breakers and all of them are made from some six thousand standard parts. The workmen shown are sorting parts for an order and placing them in trays

The *Methods* and *Equipment Used in* CIRCUIT BREAKER Construction



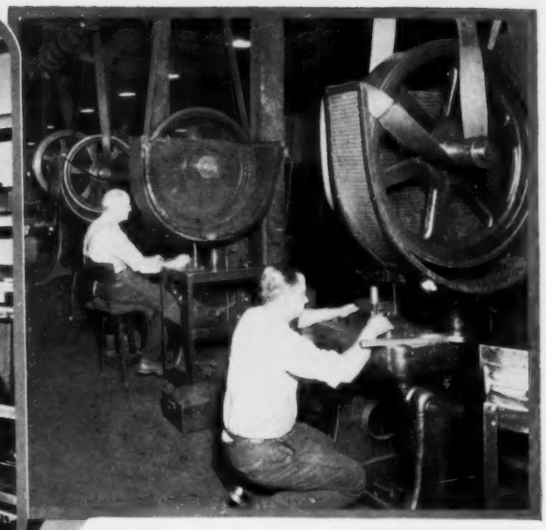
THE workman at the punch press in the illustration above is performing a rather novel operation. It is that of punching or stamping bakelite. The bakelite strips are heated to about 125 degrees in the electric oven at the right before they can be stamped



THE illustrations on this and the two following pages, together with the information on the three preceding pages describe the equipment and methods employed by the I-T-E Circuit Breaker Company of Philadelphia for building I-T-E circuit breakers and U-Re-Lites. All of this work, which is extremely accurate, is performed in a large, well-lighted industrial building with the most modern equipment.

ABOVE and at the right are two views in the machine shop. The machine in the foreground in the view above is a centerless grinder, and at the right is a multiple drill press

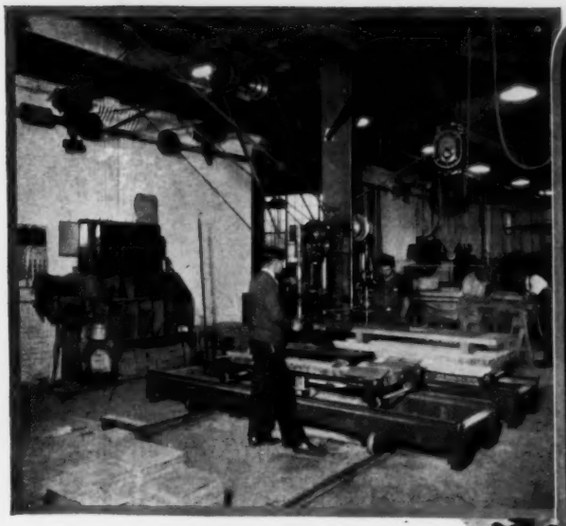
AT the extreme left is a view of the plating room, showing the arrangement of the plating vats and revolving tubs, while the man at the machine in the oval is drilling slate for use in making circuit breaker panels.



IN the illustration at the upper left-hand corner of this page may be seen one of the several rows of metal shelves in the tool vault of the I-T-E Company. Hundreds of costly special hand-made tools, dies, punches and other devices are required in the production of circuit breakers, and these are stored in the manner shown when they are not in use. Each of these tools bears a number corresponding with that of the circuit breaker part it is intended to produce, and each tool has a certain place on the shelves in the vault. The view above shows a row of the many punch presses used by the I-T-E Company. These are required for punching and forming the metal cases and many other circuit breaker parts

THE illustration above shows a group of workmen engaged at assembling U-Re-Lites. Each workman assembles one unit of the U-Re-Lite, after which the several different units are combined into the complete device. This work is carried on in the new addition to the original plant of the I-T-E Company, which, as can be seen, is of the modern type of construction arranged for mass production

AT the left is the lacquering and paint spraying room where the various circuit breaker parts are finished, while the view above shows workmen assembling I-T-E circuit breakers. This work is performed by placing the panels in racks, which can be adjusted to any position that is convenient for the workmen



THE view above shows a section of the department in which the slate for the panels is prepared and the machines in the foreground are used for drilling the slate. At the right is a general view of the machine shop section of the plant. In it are machine tools of almost every type and kind, and all of them of the most modern designs. As the manufacture of circuit breakers does not permit of mass production, the different tools are placed in groups. For this reason the foreman of each department is required to plan his own work, and this is arranged so that the various machines produce standard parts and special parts for the two different types of circuit breakers manufactured by the I-T-E Company

ABOVE is a view of the center aisle in the raw material store room. This department occupies the entire basement of the factory building, and the racks and bins contain all manner of materials used in circuit breaker construction. To conserve space, these are cut into small pieces of the proper size for making the parts for which they are intended, after which they are piled in their proper racks or bins

THE view above shows another section of the machine shop, and in the foreground may be seen a large multiple spindle drill press. At the right is the grinding and polishing department. As many of the circuit breaker parts require a high degree of finish, considerable effort is expended in the grinding room

The Radio Industry Has Special Resistor Requirements

THE Radio Industry, with the advent of the A. C. set, becomes a large purchaser of resistors and rheostats designed for relatively heavy-duty service.

Resistance requirements run from an untapped unit of a few ohms to multi-step units totalling many thousands of ohms in resistance.

Terminal requirements are frequently special; mounting arrangements and economy of wiring often depend upon obtaining an unusual type.

The size and shape of a resistor, too, is frequently determined by available space and circuit components.

Delivery on schedule is a vital factor in this new industry; the peak of production and demand is sharp.

During these past two years, while the Radio Industry altered its production requirements, Ward Leonard prepared for the new demands.

Today Ward Leonard supplies Vitrohm Resistors and Rheostats to practically every large radio manufacturer in the country. To the proven worth of Vitrohm has been added a knowledge of Radio's special requirements and complete facilities for meeting them adequately.

A New Resistor Bulletin For the Electrical Industry

Bulletin 63, Vitrohm (vitreous enamelled) Resistors, has just been completely revised. This booklet contains a complete discussion of Vitrohm Resistors, methods of mounting, types of terminals and other information of general interest. It will be sent to you, without charge, upon request.

Ward Leonard Electric Co.
Mount Vernon, New York

WARD LEONARD ELECTRIC CO.

resistor specialists for more than 37 years

SALES Engineers Taught to KNOW the *Product*

Only through shop training can the technical graduate salesman of electrical equipment gain the necessary knowledge of the product he sells. With a systematic training plan, students are given this shop background in a period of six months

By B. T. McCORMICK
Wagner Electric Corporation

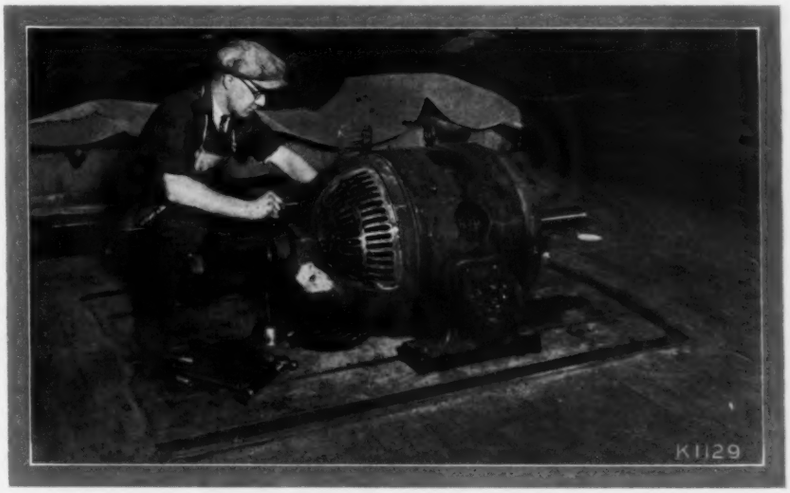
SALESMEN of the Wagner Electric Corporation, St. Louis, are almost entirely enlisted from the ranks of graduating classes of engineering colleges throughout the country. The course of special sales training described in this article is intended only for technical graduates. This course was instituted primarily to fit those technical graduates for positions in the sales department, although some few are selected for the engineering department, and others may ultimately find their way to other factory divisions.

The course includes a six months' period of shop training, which is not intended to produce expert mechanics or testers, but only to familiarize the students with the products the company manufactures and to give them an understanding of the functions of the various company departments. In the case of a man pursuing the sales line of the company's work his training in the shop is supplemented by six months in the sales department of the home office prior to any assignment work in the field.

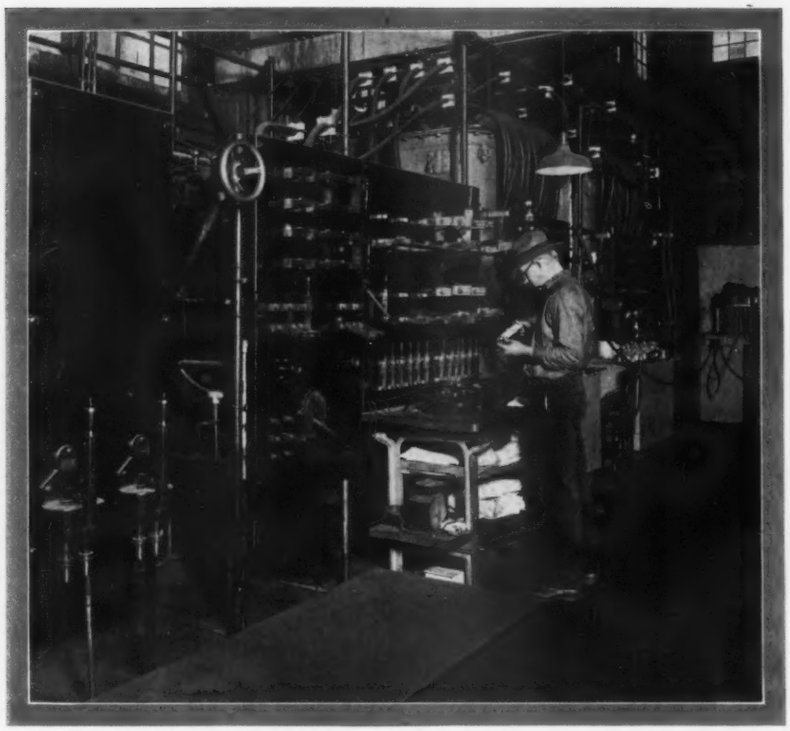
The shop course comprises a month in each of the following six departments: motor winding, motor assembly, motor test, transformer assembly, transformer test, and production department. A complete schedule is prepared in advance, showing the names of all students, the order of movement from department to department, and the dates when these movements are to take place. At the beginning of the course a copy of the schedule is presented to each student and to each foreman concerned. All interested parties, therefore, know in advance when a transfer from one department to another is to occur, and all students are expected to report to the next assignment on the date prescribed by the schedule, without any further instructions.

By this method transfers take place automatically and supervision is reduced to a minimum. The company adheres closely to the schedule and seldom does it find it necessary to make any changes. The student knows his assignments in advance, and he is assured that he will not become fixed in one department and have to beg his way out. The company takes particular care to guard against failure to transfer a student to his next assignment as prescribed on the schedule, because it is realized that such a failure would tend to demoralize the whole class.

The director of the course consults frequently with the foremen regarding the work of the students in their departments, and each foreman is expected to submit to the director at the end of the course a list of the students, graded according to merit. It is interesting to note that these lists, although prepared independently, bear a close likeness. This rating list is not prepared by any elaborate method of grading, but rather represents the foreman's judgment of the ability and strength of personality of each student, according to his work in the department.



The above illustration shows a graduate student who has just finished assembling a Fynn-Weichsel motor and is making final brush adjustments. The shop course comprises a month in each of the six manufacturing and test departments



Above is shown a graduate sales student making a test in the transformer test department. It is necessary for every successful salesman to be thoroughly familiar with the testing methods and performance data of all products made by the company

During the first six months regular weekly meetings of the students are held, at which executive officers or engineers of the company are present to participate in the discussions. At these gatherings opportunity is given to ask any questions which the students may think important, and for ample discussion of theory, processes, management, and company policy. Such meetings as these are generally devoted to lectures, and all students are required to take notes. This note keeping is thought important, because it keeps the main ideas stressed in lectures in the foreground of a student's mind. At the completion of the course these notes are submitted to the course director, who examines and returns them.

Reports Required of Students

USUALLY students are requested to submit a report at the end of the first two months. This report is intended as a gage of student caliber. His originality, powers of observation and ability to express himself clearly and accurately are indicated by the type of report he has prepared. In order to allow the greatest possible latitude no subject is prescribed. A student may write of his impressions of the course or he may dissertate upon any subject appealing to him. A short report is all that is expected. Three pages constitute the normal report.

Occasionally a student may be called upon to prepare a talk to be presented before the other members of the class at its next meeting. The subject for such a talk generally pertains to some particular machine or device which he has observed during manufacturing processes.

Reports or problems which involve considerable night work and highly technical treatments of subjects are carefully avoided and eliminated, as far as possible. All students of the course are supposed to have received thorough theoretical training in engineering colleges, and the Wagner course is designed to be intensely practicable.

At the end of the shop course students who are preparing to sell the company's products devote another six months in the home office of the sales department in St. Louis to add to their sales knowledge. Their time is divided proportionately among the various divisions of that department. This part of their training is essential so that the embryo salesmen may become proficient in correspondence and become familiar with routine of the organization. This completes the course and the sales student is then assigned to a branch sales office.

If possible in making such assignments men are placed in a district or section of the country with which they are familiar, for they are likely to do better sales work in a locality where acquaintances have already been cultivated. In fact it often happens that a salesman has been selected and sent to St. Louis by a branch manager to be trained in sales work in this manager's particular office.

The problem of student selection deserves some mention. Classes in this course are small. There are many more applications than there are vacancies. Therefore the company is in a position to exercise particular care in the selection of its students. The former method of beginning with a large class and then weeding out the undesirables later in the term has long been discontinued by the Wagner Electric Company. Only men who appeal to the interviewer as probable good timber are accepted. Once the company has invited a man to take the course it does so with the intention of keeping him with the company. Only technical graduates of high-standing engineering colleges are considered. A man is never selected without a personal interview.

It might at first seem that such a course of six months' training in the shops is negligible, but it must be remembered that the purpose of this shop training is not to make expert erecting engineers or expert mechanics. The course is intended merely to familiarize men who are pursuing salesmanship with the products of the company.

All shop work is coordinated with class work, so that a student is taught, in the least possible time, the significance of factory processes in terms of salesmanship. The course has been thoroughly tested. Its success is the most important proof of its merit.

Qualifications of Students

A BRIEF examination of the company's application requirements will indicate the qualities and collegiate experiences which the company considers of inestimable value. Besides desiring such information as an application usually calls for, such as: name, address, age, weight, height, university or college, date of graduation, degree, nationality, general condition of health, etc., the Wagner Electric Company requires the following:

Scholarship rank: 1st, 2nd, 3rd, or 4th quarter in your class.

How have you spent your summer vacations since entering college?

To what extent are you or have you been interested in: (a) Athletics—(b) Journalism—(c) Class affairs or student organizations?

Membership in College societies: (a) Social—(b) Honorary—(c) Technical.

(*Continued on page* 61)

MEASURING *Instruments* and *METHODS*

No. 1 of a Series on Electrical Testing Instruments and Methods

Electrical measuring and testing instruments are used extensively in the industry and this series explains their construction and their many different applications

By D. H. BRAYMER
Consulting Engineering Editor
ELECTRICAL MANUFACTURING

IN every application of electrical equipment there are definite conditions that determine the size required and the satisfactory performance under average requirements of service in which the equipment is employed. These requirements of service call for electrical and mechanical tests which require adequate test equipment. For electrical testing suitable instruments are essential and in this series of articles, practical details will be given on the selection of these electrical test instruments, the principles on which they operate and ways they can be employed. Other sections will take up testing connections and the various methods for securing essential data for the proper selection of ratings of direct and alternating current motors and their application to various machines.

This article will deal particularly with the different electrical instruments used in testing, including the following: Ammeter, voltmeter, voltammeter, wattmeter, power-factor meter, frequency meter, shunts, multipliers, current transformers, potential transformers, and the instruments required for special tests.

Uses of Ammeters and Voltmeters

AN ammeter is designed for connection in series with a circuit in which the current in amperes is to be measured. The connection is such that a part of the total current passes through the instrument depending on the value of this total current in amperes as will be explained later under the subjects of shunts used in direct current testing and current transformers used in alternate current testing.

The essential difference in the ammeter and the voltmeter is in its use. As already mentioned, the ammeter is connected in series with the circuit and the voltmeter in parallel as shown in Figure 1. All voltmeters are essentially ammeters, the former having a scale reading in volts and the latter in amperes. The operation of both instruments is based on Ohm's law, $I = E \div R$. Since the current passing through the ammeter depends on the circuit in which it is connected, R the resistance of the coils is low, a few thousandths of an ohm. The current passing through the voltmeter is limited by the resistance of its coils which in comparison is high or several thousand ohms. In either instrument the resistance of the moving elements is constant so that the current through it is proportional to the pressure drop IR in volts and also to the main current of the circuit. With R large as in the voltmeter, the current passing through it is small and varies as the voltage across the instrument terminals with the scale graduated to give this variation in volts. In the ammeter, the current passing through the instrument connected in series is proportional to the pressure drop IR, through the movable element and therefore directly proportional to the main current with the scale graduated to give this variation in amperes.

Since the ammeter and the voltmeter operate on the same general principles, it is possible to obtain one instrument for test work provided with two sets of terminals, so that either amperes or volts can be read according to the connection used.

Wattmeters and Their Applications

THE wattmeter is used for measuring the power or watts taken from a circuit. In a direct current circuit, this is equal to amperes times volts (I x E) and in a single phase, alternating current circuit equal to amperes, times volts, times power factor (I x E x P. F.) For measuring watts in a direct current or single phase alternating current one wattmeter is used, but for a three phase alternating current circuit, two single phase wattmeters are required, or one Polyphase wattmeter, as will be explained in the section dealing with the use of these instruments.

Since the product of amperes and volts equals true watts only in a direct current circuit, the wattmeter is essential for tests on alternating current circuits in all cases when the power factor is other than unity.

The wattmeter as shown in Figure 2 consists essentially of two elements. One, the fixed or current coils with few turns of heavy wire and the movable or potential coil of many turns of fine wire. The construction is such that the main current of the circuit flows through the current coils and a small current in phase with the voltage across the circuit flows through the potential coil. The current in the current coils is proportional to the load current at each instant, and the current in the potential coil is proportional to the voltage across the load at the same instant. The torque moving the instrument pointer then is proportional to the instantaneous power or watts and the average torque during each cycle of current and voltage is proportional to the average power. The scale is graduated in watts, or kilowatts, the latter being watts divided by 1000.

The wattmeter is therefore a combination of a voltmeter

and an ammeter operating on the same movable element so that the deflection of the pointer is proportional to the product of the current in the circuit, and the voltage between the terminals of the voltage coil. The ammeter element sets up a flux with which the volmeter element reacts to cause a deflection of the pointer proportional to the power in the circuit expressed in watts. A single phase wattmeter indicates true watts also in a direct current circuit, since the condition in the instrument is the same as when the power factor is unity.

In a single phase alternating current circuit, as already mentioned, the wattmeter indicates true watts which equals I x E x P. F. The apparent watts is the product of I x E

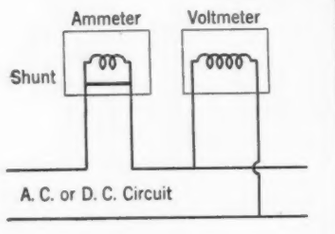


Figure 1

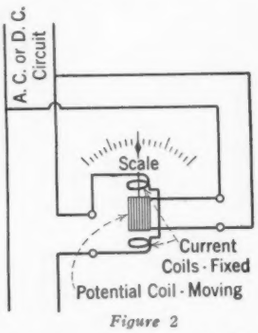


Figure 2

Figure 1 illustrates the elements of both ammeters and voltmeters, while Figure 2 is a diagram showing the operation of single phase wattmeters

as measured by an ammeter and voltmeter. Powerfactor can then be obtained by dividing the wattmeter reading by the apparent watts (True watts ÷ I x E). It is convenient, however, to use an indicating Powerfactor meter, so that the Powerfactor can be read direct at the time a wattmeter is being used, without the assistance of the ammeter and voltmeter.

The elements of one type of indicating single phase Powerfactor meter are shown in Figure 3. It consists of two movable coils at right angles to each other and two stationary coils connected in series with the load. The movable coils are connected across the load or across the different phases of a polyphase circuit. If the current in the stationary coils is in phase with that in either of the movable coils, the plane of one movable coil coincides with the axis of the fixed coils. If the current in the fixed coil is not in phase with that in either of the moving coils, the moving element is deflected and the angle of deflection is equal to the Powerfactor angle. Three-phase Powerfactor meters operating on a similar principle are also available. The scale of these instruments is usually marked 0.5—1.0—0.5, to indicate leading or lagging Powerfactor. A reading of 0.5 would indicate that the Powerfactor was 50 per cent or the true power 50 per cent of the apparent power measured by the ammeter and voltmeter, as shown by the formula Powerfactor = wattmeter reading ÷ I x E for a single phase circuit. When a Polyphase Wattmeter is used, the formula is as follows: Three-phase Powerfactor = wattmeter reading ÷ I x E x 1.73. In a three-phase circuit the Powerfactor will be the same in all phases, when the phases are balanced. When not balanced, each phase will have a different Powerfactor, hence the advantage in using the Powerfactor meter to determine this fact.

These meters are of the vibrating reed type and the split-phase type. In the former a series of steel strips of different lengths are mounted in front of an alternating current magnet. The strips whose natural period of vibration correspond to the frequency of the alternating current, will vibrate and show the frequency on a calibrated scale.

Frequency meters of the split-phase type, Figure 4, have one coil connected to the main circuit in series with a non-inductive resistance. The current in this coil is independent of the frequency. Another coil is connected to the same main circuit in series with an inductive resistance, so that the current in this coil will vary as the frequency varies. At a particular frequency, the torque of one coil is equal and opposite to that of the other, and the pointer will be practically still. As the frequency increases or decreases the torques are unequal and the pointer will show this variation in frequency on a suitable scale. The torques created by the two coils act through an aluminum disc, the rotation of which is transmitted to the indicating pointer of the instrument.

The current of elements of an ammeter or wattmeter might be built to carry the total load current, but such an instrument would be large and expensive. When large direct currents are to be measured, that is values above 200 amperes, only a small part of the main current is passed through the instrument by the use of a shunt. This shunt is simply a low resistance unit, the resistance value of which bears a fixed ratio to the resistance of the moving element. For switchboard ammeters reading below 200 amperes, and portable ammeters reading below about 100 amperes, the shunts may be built into the instrument itself. For larger values separate shunts and leads to the instrument are used.

Ratings for Shunts in Ammeters

AN ammeter used with a separate shunt and leads is in effect a milli-voltmeter which measures the voltage drop across the shunt as shown in Figure 5. This can be explained by Ohm's Law, I = E ÷ R. In the case of a shunt having a resistance of 0.001 Ohm, and an instrument reading 50 milli-volts, then I = 0.050 ÷ 0.001 = 50 amperes.

Shunts are rated in amperes with a standard potential drop of 50, 75 or 100 milli-volts. Ampere ratings may be obtained from 1 to 30,000 amperes, but standard sizes range from 1 to 5,000 amperes. In portable form, capacities up to 25 amperes can be obtained enclosed in a fibre tube. Above that value they are usually mounted on a wood base with line terminals and separate terminals for connections to the instrument. Since the potential drop is constant in these shunts for any particular ammeter or wattmeter, they can be interchanged so that the same instrument can be used with the small or the large value shunts. The instrument, however, should have the same milli-volt drop as the shunt, and in trade catalogues, meters for use with shunts are rated in milli-volts. Switchboard in-

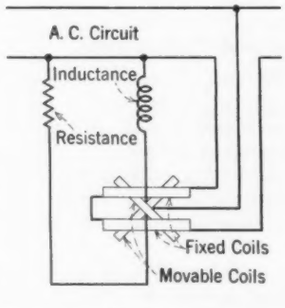


Figure 3

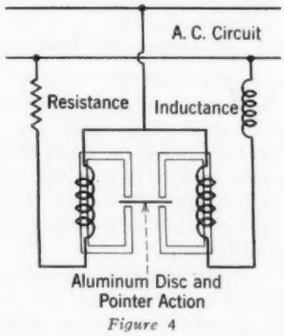


Figure 4

Figure 3 shows a diagrammatic arrangement of the elements in Powerfactor meters, while Figure 4 shows the operation of a single phase frequency meter

struments, therefore, are rated as 0-50 or 0-75 milli-volts, etc., with the scale calibrated to suit the current value of the shunt to be used. In the case of portable ammeters, the rating in milli-volts may be selected to agree with the drop of the shunts used or 50 milli-volts, and this instrument used with other current values of shunts with the same

milli-volt drop and a multiplier used for reading the correct amperes from the indication on the instrument scale.

On alternating current circuits, the current transformer is used with ammeters and wattmeters for the same purpose as the shunt is used in direct current tests. The primary of the current transformer is connected in series with the main circuit and the secondary to the instrument as shown in Figure 6. The usual designs for portable testing instruments is such that when the primary is fully loaded, the secondary winding will have induced in it a current of 5 amperes. Ammeters and wattmeters for use with those current transformers should, therefore, have current elements rated at 5 amperes capacity. The actual reading of the current flowing is obtained by multiplying the reading of the instrument scale by the ratio of primary and secondary amperes of the current transformer connection used. A ratio of 20 amperes in the primary connection to 5 amperes in the secondary would be a 4 to 1 multiplying ratio, so that the instrument reading must be multiplied by 4 to get the correct value of current when a 5 ampere ammeter is used. The same would be true in the case of a wattmeter when no potential transformers are required.

Operating Theory of Current Transformers

THE operating theory of the current transformer is based on the fact that there is a constant ratio between the primary and the secondary voltage of a transformer. The voltage of the secondary is proportional to the current flowing in the primary, so that with the impedance of the secondary constant, the secondary current is proportional to the primary current in the current transformer. This principle must be understood when using these transformers for the reason that when the primary current is flowing the secondary voltage increases with the impedance of the circuit, making it imperative that the secondary circuit should never be opened with current flowing in the primary. Should it be necessary to remove an instrument from the secondary of a current transformer while the primary is connected, the secondary terminals must be short-circuited before the instrument is disconnected or a voltage dangerous to life will be encountered. This precaution is usually noted on the name plate of a current transformer. Portable current transformers usually have leads for which they are calibrated but in case they must be used without such leads, the connection to the instrument should be made with

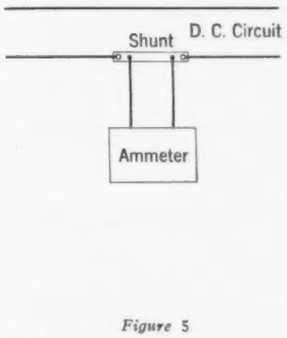


Figure 5

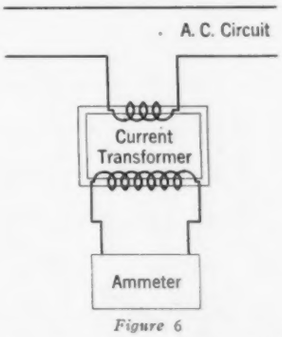


Figure 6

Figure 5 shows the connections for the use of a shunt with an ammeter, while Figure 6 shows the connections and elements of current transformers

wire not smaller than No. 14 B & S gauge, and not over 10 ft. long. For longer connections wire equal to No. 10 B & S gauge should be used.

In case a bus bar or looped type of current transformer is used in which the main primary leads are looped through the center of the core, several times to reduce the value of primary current, it is important that when the conductor is looped through the core and on both sides that the direction of winding must be changed so that the instantaneous current flow is through the core in the same direction in all loops. This is shown in Figure 7. A current transformer of 25 volt-ampere capacity will permit the use of either an ammeter or wattmeter, or both together on the one unit.

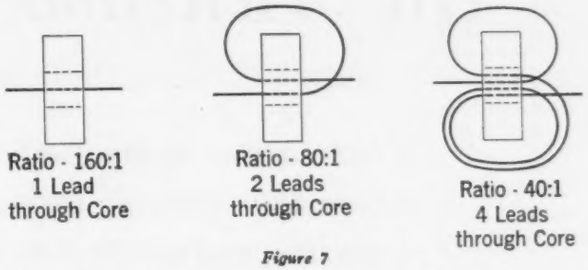


Figure 7

Figure 7 illustrates the method of connecting a primary in open primary current transformer with leads through core in the same direction

To increase the voltage capacity of voltmeters and wattmeters, both A. C. and D. C., a non-inductive external resistance is used, and connected in series with the current carrying element of a voltmeter Figure 8, or the voltage element of a wattmeter. This resistance simply reduces the voltage that would otherwise be applied to the instrument. This resistance or multiplier must have a resistance value that bears a ratio to the resistance of the meter element, so that when used the voltage of the circuit will be some multiple of the instrument scale calibration. Multipliers are not, therefore, interchangeable with different instruments, and must be obtained for the particular instrument with which they are used. Voltmeters may be obtained in portable form, however, with single, two or three voltage ranges up to 750 volts, without the use of external resistors.

Potential transformers operate on the same principle as

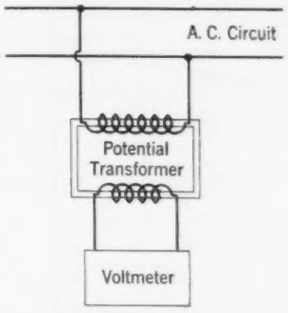


Figure 8

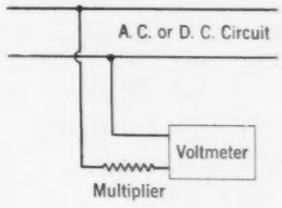


Figure 9

Figure 8 shows the connections and elements of a potential transformer, while Figure 9 shows the use of multipliers with A. C. or D. C. voltmeters

the power or distribution transformer, and are of the step-down type, as shown in Figure 9. They are furnished for 60 cycle or 25 cycle service. When these transformers are used, the primary voltage is the indication of the voltmeter times the ratio of transformation. They are made for all primary voltages, with secondary voltage of 110, so that they may be used with voltmeters having scales of 0-150 volts. These transformers can be used with wattmeters, frequency meters and Powerfactor meters. For use with a single instrument a capacity of 15 volt amperes will usually be sufficient, but when one voltmeter and two other such instruments are to be used on the same potential transformer, a rating of 50 volt amperes is required.

When using only a current transformer or a potential

(*Continued on page 66*)

Characteristics That Determine the *Selection* of MOTORS

No. 8 of a Series Discussing Motors of Different Types

There are a number of machine tool applications where the constant torque, variable horse power, multi-speed motor can be used advantageously

BY THEODORE SCHOU
Consulting Engineer, Fairbanks, Morse & Co.

AND

C. P. ROBINSON
Synchronous Engineer, Ideal Electric & Mfg. Co.

THE following article is the second section of a treatise on the characteristics and the applications of multi-speed motors. The first section was published as article No. 7 in the December, 1928, issue of ELECTRICAL MANUFACTURING, where, in addition to the general information on this subject, the constant horsepower duty motor was described in detail.

(b) *Constant Torque—Variable Horse Power:* It may be said that, fundamentally, all of the types of multi-speed motors are the same, the distinctions being made only according to the application.

The first motor which we will discuss under this heading

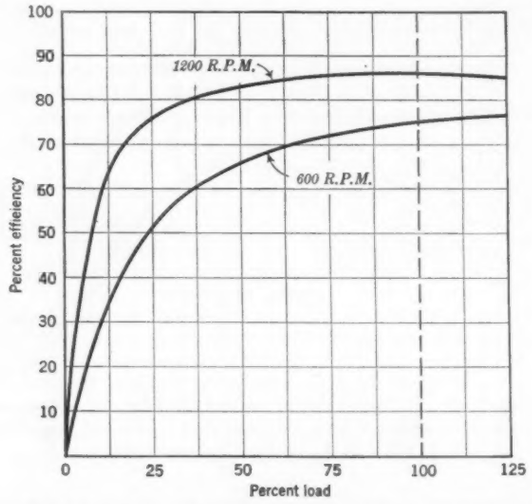


Figure 7 shows a comparison of the efficiency of a constant torque motor with one stator winding reconnectable for two speeds

is one rated 15 hp. at 1200 r.p.m. and 7½ hp. at 600 r.p.m. of the consequent pole type, having one stator winding, reconnectable, to give the two speeds.

Figure 7 shows the efficiency curves for the two speeds. Figure 8 shows the power factors at both speeds. The low speed power factor in this case is considerably below the power factor of a standard motor rated 7½ hp. at 600 r.p.m.; otherwise the characteristics compare very well with standard motors. The problem in a multi-speed motor is actually to design several motors in one. Each separate winding is designed for a particular duty. It is not, of course, to be expected that the characteristics will be as good when several motors are combined in one; as when each rating is built separately, but nevertheless, the multi-speed motor holds its own when compared to other variable speed motors. Figure 9 gives the inrush currents and Figure 10 the torques for the two windings. It will be noticed that the torque curves for the two speeds are quite close together, which shows that throughout the range from starting to maximum or pull-out torque, the characteristic of constant torque is maintained.

The application of this motor was to machine tool drive. There are a number of machine tool applications where such a constant torque multi-speed motor might be used,—for instance in driving lathes, planers, or drill presses, and other similar applications, where different speeds can be used for different classes of work.

Another constant torque motor rated 10 hp. at 1200 r.p.m. and 7½ hp. at 900 r.p.m. was built having a double squirrel cage rotor. This is interesting as it shows the

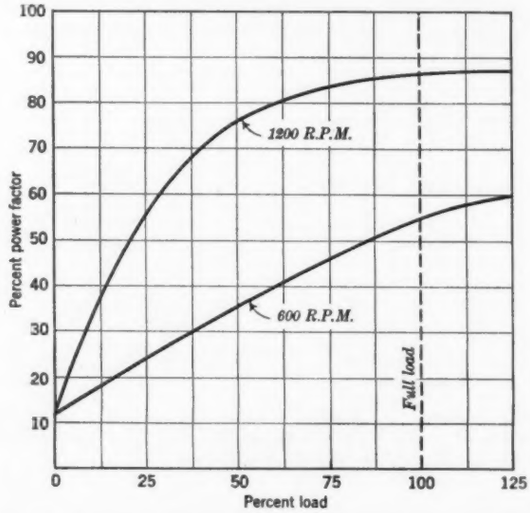


Figure 8 shows the power factor curves at two speeds for the motor whose efficiency curves are shown in Figure 7

possibility of adapting the multi-speed motor for starting across the line, eliminating the compensator. This motor had two separate windings, in contrast to the constant

torque motor described previously, which had only one stator winding.

Figure 11 shows the efficiency curves for this motor, Figure 12 the power factors, Figure 13 the inrush currents, and Figure 14 the torque curves. Figure 13 shows the typical inrush characteristics of a double squirrel motor, inasmuch as the inrush on both windings is below 400 per cent, as compared to inrush currents of 500 to 600 per cent for standard single squirrel cage motors at the same ratings and speeds. A multi-speed motor could also be adapted to the single squirrel cage across the line start motor, by providing the proper rotor design as described in the October issue of Electrical Manufacturing.

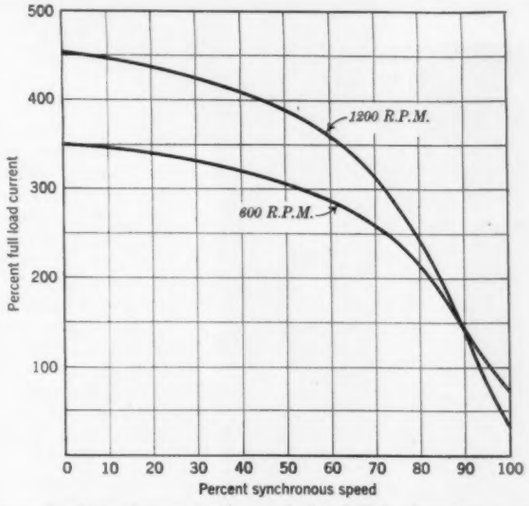


Figure 9 gives the comparison of the full load current curves of the same motor as that in Figures 7 and 8

Notice also that the torque curves in Figure 14 are quite characteristic of the double squirrel motor. See October issue of Electrical Manufacturing. The curves show the usual somewhat flattened torque curve with the sharper peak near synchronous speed.

The application of this particular constant torque motor is rather interesting. It was applied to a punch press. (See Figure 15.) The original installation had a slip ring motor which however was so unstable for this varying load that the operator could not properly control the output, and it was necessary to make the change. When the change was

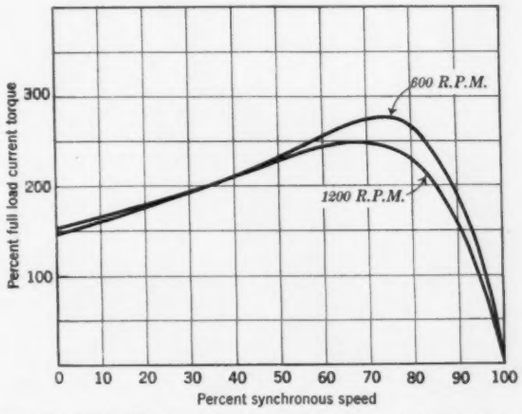


Figure 10. This illustration shows the per cent full load torque developed at different speeds by the constant torque motor

being discussed the fact was mentioned that it was desirable to use this press for two different standard punchings. The nature of these punchings was such that one kind could be punched satisfactorily at the rate of 96 per minute, whereas the other kind could only be punched at the rate of 75 per minute, and still provide clean, sharp punchings. So the multi-speed motor of the constant torque type was suggested, and built for the job. It has been operating satisfactorily for several months.

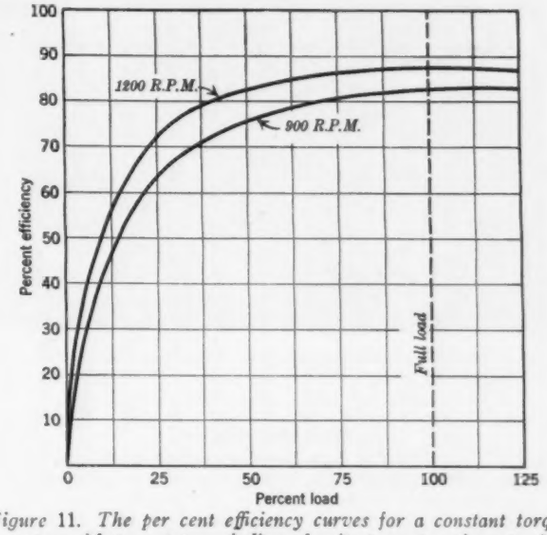


Figure 11. The per cent efficiency curves for a constant torque motor with two stator windings for its two operating speeds

Figure 16 shows an installation of a two speed elevator motor of the constant torque type rated 18 hp. at 1200 r.p.m. and 7 hp. at 450 r.p.m. with the two stator windings.

Multi-speed motors have been in use for elevator service for a number of years. This is one of the largest fields, so far developed for multi-speed motors. A large number

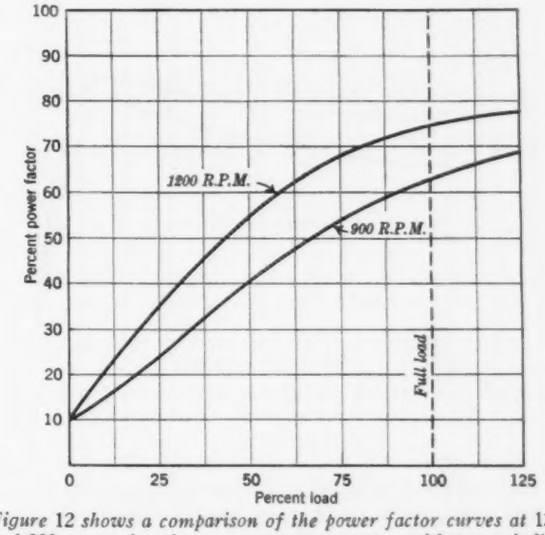


Figure 12 shows a comparison of the power factor curves at 1200 and 900 r.p.m. for the constant torque motor with two windings

of these motors are built each year by practically all of the manufacturers building alternating current motors above fractional horsepower ratings.

These motors are of the two speed type, and may be either consequent pole type, or two stator winding type. However, as will be seen later, the two stator winding type seems to be preferable.

The characteristics of these motors will parallel those shown in this article except that the rotors are of the high resistance type, intermittent rated, and provide torque characteristics typical of the torque curves shown in the September issue of Electrical Manufacturing. The elevator motor, since it is constantly starting and stopping,

and has no continuous duty rating, is always designed on a torque basis, rather than a horsepower rating. The high resistance rotors, of course, provide the best starting torque.

It is generally realized that the two speed alternating current motor is not satisfactory as compared to the variable voltage, geared, and gearless direct current motors for elevator service. A few remarks made at a recent meeting of the Elevator Manufacturers' Convention at Hot Springs, Va., shows what the general conception of the two speed alternating current elevator motor is.

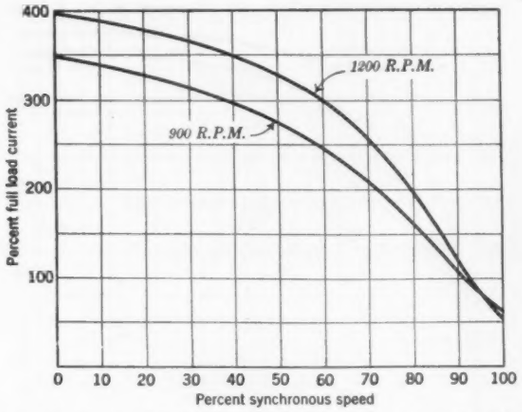


Figure 13. Per cent full load current drawn by a constant torque variable horsepower motor with two stator windings

At this convention it was conceded that of the three different types of two-speed A.C. elevator motors; the two unit machine, the reconnectable or consequent pole type, and the two stator winding type, that the latter was by far the best, but it came a long way from meeting the requirements of a good elevator motor. After much discussion it was also conceded that the low speed winding should have from 75 to 80 per cent of the starting torque of the high speed winding, and that it was best to start accelerating the elevator on the low speed, and then transfer to the high speed winding, as this gave a cooler motor.

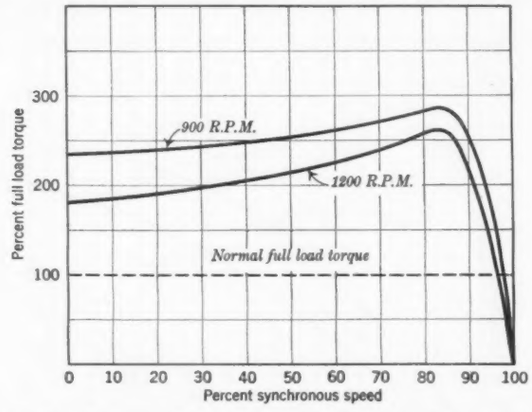


Figure 14. Per cent full load torque curves for different speeds for the constant torque two winding motor

It is true enough that the alternating current motor can probably never attain the smoothness of acceleration and of operation that is characteristic of the direct current variable voltage control. Notwithstanding this fact great strides are being made in providing a better elevator motor of this type.

For instance, when the A. C. motor was in its first stages of application to elevator service, the motor was always started on the high speed winding, the low speed winding being used only for dynamic braking to aid in bringing the elevator to a stop, thus reducing the stress and wear on mechanical brakes over the use of a single speed motor. Then the low speed winding began to be used for starting as well as dynamic braking. This meant that the low speed winding was designed for the service and a motor of practically constant torque rating resulted.

Another very serious trouble that arose was the noise which developed on dynamic braking. This noise was of extremely high pitch and the elevator shaft accentuated the noise until it became very disturbing, particularly in apartment houses and public buildings. The elevator motor manufacturers have made remarkable strides in reducing this magnetic noise, to the extent that such noise is practically negligible and can scarcely be heard when standing alongside of the motor. Particular mention must be made of the Lincoln Electric Company of Cleveland, Ohio, who spent a large amount of time and effort in research, and who were among the first to produce a satisfactory motor in commercial quantities. Haughton Elevator Company of Toledo, Ohio, cooperated closely with the Lincoln Electric Company in this work and should also be given due credit for the success made of the study.

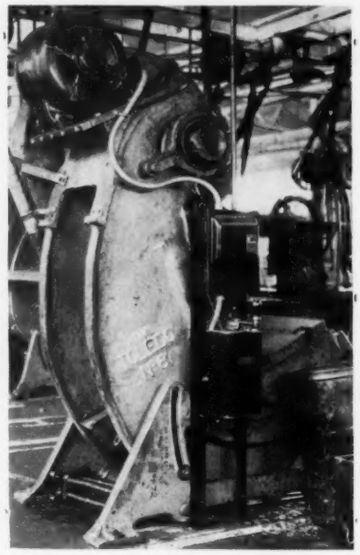


Figure 15. It was desired to use this press for two different standard punchings. One kind could be punched at the rate of 96 per minute and the other at only 75 per minute and still provide clean sharp punchings. The constant torque multi-speed motor with two windings was used and has been producing satisfactory results for several months

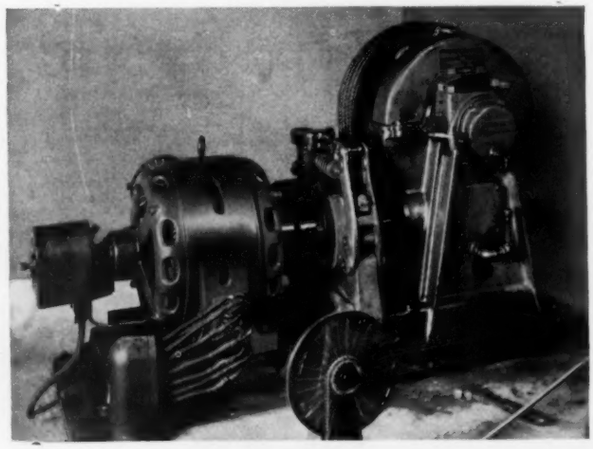


Figure 16. An installation of a constant torque motor rated at 18 hp., 1200 r.p.m., and 7 hp., 450 r.p.m. with two windings

When the two speed A. C. elevator motors were in the first stages of development, the speed ratios were usually

two to one. This has also been made a matter of study and the result has been increasing ratios, so that six to one ratios are now commonly used, and even twelve to one

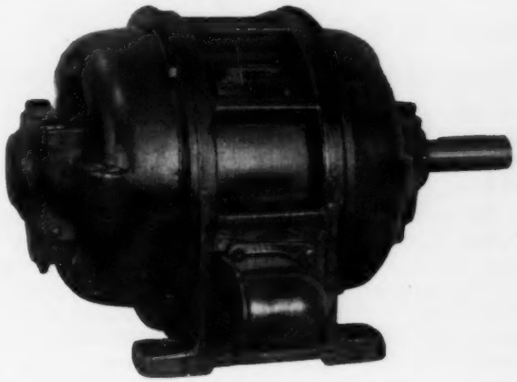


Figure 17. A G. E. multi-speed motor for elevator service

ratios in limited cases. The twelve to one ratio, for example, was from 1800 r.p.m. on the high speed winding to 150 r.p.m. on the low speed winding. This has resulted in two things, a smoother deceleration of the elevator car

Figure 18. A Haughton elevator machine driven by a Lincoln motor. When two-speed motors were first adopted for this service the speed ratio used was two to one, but this has been raised so that six to one ratios are now common

on dynamic braking, and higher speeds for A. C. elevator service. The results of these developments have produced an A. C. elevator motor that is fairly satisfactory, and

Figure 19. Several Lincoln-Haughton elevator machines and the control equipment for them installed in a building

subsequent developments, will probably make it even more so.

Figures 21 and 22 show the torque characteristics for

Figure 20. Increased speed ratios in elevator motors has resulted in smoother deceleration of the car and higher speeds

typical two speed elevator motors of the squirrel cage induction type. Figure 21 shows the characteristic of the three to one speed ratio motor and Figure 22 shows the characteristic of the six to one speed ratio motor.

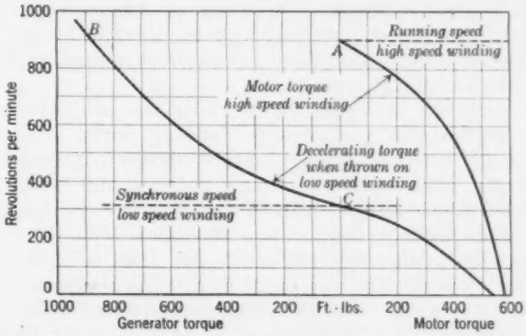


Figure 21. Characteristics of a three to one speed ratio elevator motor of the squirrel cage induction type

When the elevator is running normally at high speed, the operation is at A on the curve. The retardation or deceleration of the elevator consists in throwing over from the high speed winding to the low speed winding of the motor,—the operation is then at B. Since at this point, the

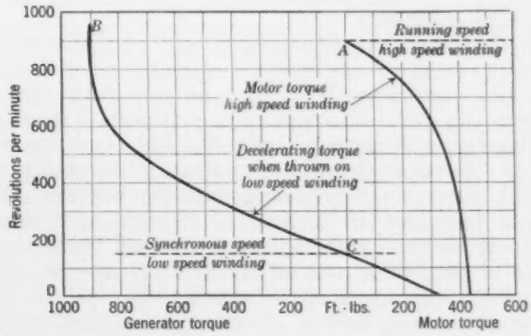


Figure 22. Characteristics of a six to one speed ratio A. C. elevator motor. Note that the deceleration is more complete than in the case of the motor with three to one speed ratio

motor is running way above the synchronous speed of the low speed winding, the motor acts as a generator and by its action retards the elevator until the low synchronous speed is reached at C. The motor is disconnected at C, and the stopping of the elevator is completed by the me-

(*Continued on page 66*)

Station G-A-G-E, Editor Speaking

Stanley A. Dennis, Editor and Assistant to the President

The Aviation Market

MANUFACTURING of electrical products suitable for use in equipping and servicing airports, intermediate landing fields, and airways do not seem as yet to have awakened to the growing market which aviation offers them. Thus far only a few such manufacturers have gone into this market. And apparently most manufacturers of electrical products that may be sold in it have failed even to investigate it.

In the United States today there are 1195 airports and intermediate landing fields now in use. The number increases almost daily. There were at last count 798 proposed airports and intermediate landing fields listed with the Department of Commerce. In addition to these, there are 4000 other fields on which landings can now be made. There are more than 10,000 miles of airways. Approximately 258 of the airports are fairly well lighted. About 6000 miles of the airways are lighted. And the number of planes actually in use requiring electrical equipment of one kind or another runs heavily into the thousands.

During the past year the necessity for adequate electric illumination for airports, landing fields, and airways has increased rapidly. Improvement in planes and in flying have steadily increased the ease and safety of night flying and the demand for aviation service has included night transportation facilities. In Europe, where flight distances are much less than in America, there is less demand for night flying, but in the United States the great distances between terminal cities on air transport lines will always necessitate night travel. And it must not be forgotten that other forms of electrical service than illumination are required on both planes and ground. Communication equipment is needed. Control equipment whereby planes approaching an airport at night automatically switch on the field illumination is required. Equipment for power is required in airport or field repair shops, and heating equipment is needed in hangar and restaurant and housing facilities at airports.

Investigations by *Electrical Record* and ELECTRICAL MANUFACTURING now under way are showing that the electrical contractor is playing an important part in buying the electrical equipment for airports. He is installing such equipment in airports and along the airways. Names of electrical contractors who are engaged in this work are now coming into the editorial office daily. Bills of electrical material required by the Government for the equipment of airways and the intermediate landing fields and similar bills of materials purchased for private or commercial or municipal airports show an amazing variety of electrical products and interesting quantities of them. The Government's requirements for electrical equipment on airways and intermediate landing fields are attractive, or should be, and its suggestions for such equipment in order to determine (in part) the rating of the airports themselves indicate that the electrical demands of the aviation market will steadily increase. And the current load for an adequately equipped airport should appeal to the executives of any central station.

A Mineral Resources Policy

MANUFACTURERS of many kinds are beginning to look with some concern on the failure thus far of the government and industry to get together on some kind of a mineral resources policy that will protect natural sources of supply. It is encouraging, therefore, to learn that the feasibility of formulating a national policy looking toward the maintenance and most effective use of the store of minerals with which nature has endowed the United States is a question that will engage the attention and effort of the United States Chamber of Commerce during the present year.

The War Department has listed a number of "strategic minerals," such as manganese, nickel and mercury, which are essential from the viewpoint of national defense. Many other minerals are equally necessary from the viewpoint of national economic development.

What can be done to assure an adequate supply of minerals upon which industry depends, what measures can be taken to conserve vanishing mineral resources which cannot be replaced, many of them of very great importance to electrical manufacturers, what methods can be devised of their economical use, and what steps may be taken to determine the availability of existing deposits elsewhere, are some of the questions to be weighed in the formulation of a national mineral policy.

During the year, electrical manufacturers will undoubtedly be given an opportunity to participate in this task, and it is one that is to be taken seriously, one that should engage their best thinking and support.

Wildcat Manufacturing

OVER-DIVERSITY in manufacture has been and still is a source of waste, and considerable waste, in the production and distribution of electrical products. Its cost is a part of almost every dollar spent by the public for waste of all kinds, waste which shames our national and economic life. The desire of manufacturers to pull away from their competitors is, in a large measure, responsible for this over-diversity.

On this point it should be worth while for manufacturers to consider thoughtfully a statement recently made by Ray M. Hudson, of the Department of Commerce. Mr. Hudson said:

"The desire of certain manufacturers to produce something different from their competitors often results in flooding the market with a surprising variety of articles which show only slight and immaterial differences in size and form. This practice has clogged the channels of distribution, congested the shelves of retailers, and the warehouses of wholesalers. This condition has gone on until the disposal of such goods has been possible only at a loss. 'Bargain sales,' 'manufacturers' special sales,' 'bankruptcy sales,' and the like have been the answer."

Bargain sales of one kind or another continue to be a source not only of waste, but also of friction within our industry. This is especially true of appliance bargain sales. Certainly it would seem that one way to undermine such sales is for the manufacturer to take more careful thought to the number of sizes and varie-

ties of appliances that he makes and attempts to market. Probably many manufacturers could be found who could greatly increase their profits, if they would enforce a policy of greater sales effort on a smaller line of goods. Such a policy has repeatedly been tried out in other than electrical fields and has demonstrated its value. Indeed, within the electrical appliance field it has proved its value many times. More applications of such a policy would reduce friction between trade groups within the field and would certainly make it easier to maintain profit-making prices on standard appliances. Unsound diversity of manufacturing hooked up with consequent bargain sales falls little short of wildcat manufacturing.

Want the Calendar Reformed?

BUSINESS men in all fields seem at last to have come to a realization that they must take up seriously the question of calendar reform. For a long time thoughtful people in many fields of human endeavor have pointed out the disadvantages and the wastes in the existing calendar and suggested various improvements. Business has been heretofore rather inclined to take these efforts lightly. But a change of thought on this subject seems to have developed.

A committee of the United States Chamber of Commerce has found that a revision of the present calendar is desirable. It has recommended that the calendar be altered so that the divisions of the year will be more uniform in length, and that the weeks be so fixed in relation to the divisions of the year that the business results of a division of the year may be compared accurately with the results of a corresponding division of other years. In the present calendar the months are of unequal length and there is no uniform basis of comparison.

The committee suggests that any decisions made by the Chamber with reference to its support of calendar reform should now be attempted only upon the question of serious defects in the existing calendar and on the methods to be followed in determining any changes. It is felt by the committee that when the demand for reform in the calendar has reached such volume that action is to be taken, that action should be taken only by an international conference.

Sooner or later the electrical industry in one way or another will be called upon to express its thought on the proposed calendar simplification. It is just as well that the subject comes up at this time, permitting opportunity for thought and study on it. It might not be amiss for the associations within the industry to give this subject some publicity within their membership, and to find the trend of sentiment on this increasingly important subject.

Reading and the Business Man

NOW that New Year resolutions have been made and forgotten perhaps, it may be a fitting time to ask oneself, "What business books did I read last year? What business books shall I read this year?"

An examination by the business executive of his reading during the past twelvemonth may not reveal any grounds for pride or congratulation, especially with reference to business books. The fact of the matter is that the American business executive does not take the time to read business books as he should and therein lies one of the greatest faults that may be charged against him. He has time for anything else that takes his fancy, but he fails to recognize the value for him in quiet and thoughtful readings of books dealing in an authoritative way with the outstanding problems of industry and commerce. Such books do exist. A few, fortunately not too many, are published each year. There can be no question about their actual value to present-day business.

If anyone doubts the accuracy of the editor's point of view on this subject, let him make it a point to ask a few of his business friends what business books they read during the past year. The books named will be surprisingly few. The editor has found only one or two central station executives who read Ripley's "Main Street and Wall Street," despite the profound influence that that book exerted in public utility circles. Any number of central station men can be found who never heard of the book. And yet it was as widely advertised in many ways as any business book of recent years. Other books could be named that have touched all fields of business, but which electrical utility and manufacturing executives fail to read and utilize to their profit.

The time is fast approaching when to a greater extent than today a business executive will be judged by his maintenance of contact with the best thinking of the hour, as made accessible in business books of unquestioned value. And it must not be forgotten that some of the best books of this kind are written by business men themselves, men who not only have time to read but to write as well. The electrical manufacturing executive who will take the time during 1929 to read two or three or more business books, tried and found not wanting during the past year, will make an investment which will yield returns for years to come.

The Franklin Plan

EVER since the Red Seal Plan was launched in the United States by The Society for Electrical Development several years ago a demand has been slowly developing in the industry that the idea of a certified installation be applied to the factory and to the store as well as to the home. While it has been recognized that the home is the great market for electrical service, it has also been evident to almost everybody that the industrial and commercial market is much too valuable to be neglected or forgotten. Now that the Red Seal Home idea has been successfully implanted in the mind of the industry, it is felt that the time has come to apply the same idea in other markets.

It is not surprising, therefore, to learn that the board of directors of The Society for Electrical Development, at its annual meeting recently, endorsed a lighting plan for industrial and commercial interiors. The name of this plan has been announced as the "Franklin Specification Plan," but this will undoubtedly be shortened to "The Franklin Plan," a twin, as it were, to the Red Seal Plan. Just as installation under the Red Seal procedure is followed by inspection and certification, so will a similar procedure be developed under the Franklin Plan. The specification will be national in character under copyright by The Society for Electrical Development and will be applied locally by either central station or local league or both acting under license issued by the society.

To manufacturers making industrial and commercial lighting equipment, to central stations, and to contractors installing the equipment the announcement of this plan should come as good news. The plan itself seems to have been launched without certain handicaps that have attended the pioneering of the Red Seal Home idea. The latter plan is still in the throes of an effort to set up a national standard and can be applied only where a local league is in operation. The Franklin Plan starts without these two handicaps. It should show quicker results than has the Red Seal Plan.

Suggestions for Manufacturers Who Buy Their Stampings—

Avoid These Errors in Ordering Stampings

"We could save our customers thousands and thousands of dollars on stampings," writes one stamping manufacturer, "if they would only use more care in ordering, and would take advantage of our long experience in the design and manufacture of stampings."

Numerous manufacturers of all kinds of stampings were asked what money-wasting and time-wasting errors electrical manufacturers make in ordering stampings, and the results of their replies are summarized in the list of errors at the right. Regarding omission of important dimensions, one specialist in fibre stampings says:

"It has been our experience that frequently the manufacturer of stampings is called upon to use considerable imagination, which sometimes works out satisfactorily and other times does not. When ordering stampings of fibre, it is necessary to have all dimensions specified. Needless to say, accurate blue prints are much more desirable than sketches or samples."

This same stamper comments on error number two as follows:

"In addition to complete dimensions, the electrical manufacturer should furnish the stamping manufacturer with complete information as to the function of the stamping. If, when ordering stampings, the electrical manufacturer would go on the assumption that he could not give too much information, both himself and the stamper would be greatly benefited."

1. Omission of important dimensions.
2. Failure to describe function of stamping.
3. Omission of tolerances.
4. Specification of unreasonable tolerances.
5. Failure to send complete blue prints.
6. Failure to indicate material, color and finish.
7. Sending of prints that have not been thoroughly checked.
8. Specification of stamping that cannot possibly be made.
9. Failure to take advantage of the stamping specialist's design and manufacturing experience.
10. Failure to take advantage of standardization.

Full Data on Drawings Essential

D. J. O'CONOR, vice-president and general manager of the Formica Insulation Company, has this to say about tolerances:

"It is often true that information given to purchasing departments by our sales force does not get into the engineering department at the time the designs and specifications are made. This is true, for instance, on such a subject as tolerances. Our material is radically different in nature from sheet metal, and the practical commercial tolerances are different. Sometimes engineers who have not used the material and are not familiar with the process of manufacture and conditions under which it is carried on, call on us for things that cannot be done or that cannot be done in regular commercial production. Sometimes smaller manufacturers will undertake to order a rather complicated piece, with many holes, by letter without blueprints—or with a rough sketch made on scratch paper in the presence of the salesman. In such cases essential dimensions and information are frequently left off and the haste, with which the drawing is made, leads to innumerable changes later on."

Another stamper comments on unreasonable tolerances as follows:

"Many draftsmen attempt to 'play safe' by specifying exceedingly close limits on even the unimportant dimensions. They do not realize that it costs money to get great accuracy, and that they are making the part unnecessarily expensive by calling for an accuracy greater than required."

Specification of material, color, and finish apply particularly to stampings made of phenolic resinous materials, such as: formica, micarta, textolite, fibroc, phenolite, and bakelite.

"We believe," says one stamper commenting on the checking of blue prints, "that a print drawn up and approved by a corporation engineer should be entirely correct before it is sent out, and where tolerances are not shown it should be understood by the stamper that a generous tolerance is allowed, on the order of .005 in. We have a case now whereon a certain machine, which required many stamping parts, was designed in the brain of an engineer and put down on blue prints before ever making up samples and trying the machine out. To date there have been 26 different changes on these prints which all came up after we had submitted samples. Of course, they asked why our production departments and inspectors had not been asked about these various prints before starting manufacture of the tools and dies. Inasmuch as orders for stamping come in by the hundred it is impossible for the stamping manufacturer to make a close check of blue prints. He must assume that the buyer's specifications are correct."

One manufacturer cautions against designing spring stampings into complicated shapes. He says:

"A common error is that a drawing will call for 'hard' or 'spring temper' brass parts, and will then show such shape and difficult bends that the piece could not possibly be made out of hard brass without cracking into bits."

The attitude of numerous stampers toward their service to buyers is typified by the following statement:

"It is always a great help to the stamping manufacturer if the customer will take him into his confidence sufficiently to explain the function of the part in question; how much load it must carry; how far it must bend; at what rate of speed it moves; and other design considerations."

Suggestions for Manufacturers Who Make Their Own Stampings—

A Stampings Expert Tells How to Save on Stampings

No. 1 of a series on the design and manufacture of stampings

"Be Systematic," says the author, describing methods for decreasing and eliminating waste in making stampings

By J. K. OLSEN
Chief Draftsman, Stewart-Warner Speedometer Corp.

J. K. OLSEN

AFTER completing his technical education, J. K. Olsen obtained a broad experience in the mechanical field. He started with the Crane Company of Chicago, where he was employed for three years in machine-shop work, patent layout, and drafting. This was followed by more than eight years as a draftsman and checker in the apparatus drafting department of the Western Electric Company at Hawthorne, Ill. Meanwhile he was taking courses in mechanical engineering. For the last ten years Mr. Olsen has been chief draftsman of the Stewart-Warner Speedometer Corporation of Chicago. Consequently these articles are backed by over twenty years' experience. Besides being a member of the American Society of Mechanical Engineers, Mr. Olsen is a representative of this society on two subcommittees organized under the procedure of the American Engineering Standards Committee

IN all branches of the manufacturing industry where raw-material is used in the production of stamped parts, the waste, scrap and spoiled raw-material is an item of great importance.

We may go as far as to say that any saving of raw-material that may be accomplished by any means is directly in line with the general conservation policy, which is of national importance and affects the prosperity of us all.

The main items to be considered in the problem of decreasing waste in the manufacture of stampings are three in number, and may be designated as waste, scrap, and spoiled parts.

I. *Waste*

Waste may be considered as the part of strip or sheet which is left after parts have been blanked out, and this item must be considered and accepted as a part of the cost of the manufacturing operation. This factor may be held to the minimum only by the use of the most modern methods in designing tools and the most careful selection of material layouts.

II. *Scrap*

This scrap item consists of unusable raw-material or stock which is purchased to incorrect dimensions, and in still another case material which leaves excessive left-over ends in the strips; this latter condition may sometimes be chargeable to a too liberal allowance in the material layout.

III. *Spoiled Parts*

The spoiled parts item is in all probability the largest factor and the most common one, as it includes the loss of material due to parts being made to the wrong dimensions, parts damaged in handling, and loss due to carelessness in assembly, finishing, etc. This material has little value. As only a small amount may be reworked and re-used, the balance must of course be sold as junk metal.

In the item mentioned under the scrap heading there is a vast field for ingenuity and originality in finding uses for the material which is not concerned in the part for which the material was originally intended, and a thorough analysis of conditions of this kind will reveal to the interested parties a number of surprising facts.

It is impossible to lay down any definite rules to follow which would be applicable to all stamped parts, since most concerns differ greatly in products and process.

In large production, or where a great number of parts are made which leave waste material of sufficient size, there is almost always a possibility that some other part may be made from this scrap material, provided the speed of stamping this second blank is sufficient to compensate for the extra handling of the waste material. However, with sufficient quantities of scrap and present-day modern equipment at hand, means may be generally found to solve this type of problem in a satisfactory manner.

A practice which is increasing in popularity is to combine two or sometimes more than two blanks in the same

die and in this manner more than one part is obtained from the raw-material strip without increasing the number of operations.

In connection with this practice it is necessary to determine whether or not the added expense of the more costly die is offset by the saving in time and material.

The blanking of a combination of parts in one operation must be balanced with the production requirements; that is, if two parts are made from the same blank, the product should require one each of the parts, and if a large blank and two smaller blanks are to be stamped from the same strip with the same die, the product must require the same ratio of parts in order to balance the production of parts and the stock requirements for production of the finished assembly or there will be a surplus of some parts.

This method, in order to be practical, must provide the correct ratio of parts, except in cases where the extra parts are common stock items such as washers, nuts, gaskets, etc.

In many manufacturing plants there are found many parts made from the same thickness, or within a few thousandths of an inch of the same thickness of material, but some of these parts will be made of brass and others of steel. In cases of this kind it is excellent practice to standardize on one material in as many parts as may be found practical. It has been the experience of almost everyone that there are too many different opinions among designers in selecting various kinds of raw-material for parts that are similar in design and function.

If, as mentioned above, a good standardization of kinds of material is accomplished, then the next favorable step is to concentrate on thickness of stock. There is no good reason why various stocks should be kept and used where there is a variation of only a few thousandths of an inch, but this is often the case, and a standardization should be attempted to eliminate this practice.

In designing a new product, there should be a definite understanding that material used for other products should be specified in as many cases as may be found practicable.

One item concerning the production of stamped parts that is seldom given due consideration is the width of strip material carried in stock. In many cases a number of parts will be made of the same kind and thickness of material, and by a slight rearrangement of material layouts the use of a standardized strip size may be adopted without increasing the weight per piece.

In standardizing on the width of strips it is readily seen that larger amounts of each size may be purchased on each order, resulting in a decrease in price. In addition to the saving in cost, the standardized strip widths will provide a flexible raw-material inventory.

When parts are designed, or redesigned, it is evident that any possibility of using lighter gage stock than that which might seem necessary will be a direct step toward cost reduction. In modern design and production of parts, there is an unlimited chance for improvement by using such features as forming and embossing to obtain strength from lighter gage materials.

Attention should be directed to parts which are not strictly modern in design, and in many cases these parts will be found much thicker or made of much heavier material than is required.

IN this first article of a series on methods of saving money on the design and manufacture of stampings, Mr. Olsen discusses the problem of saving raw material. This series of articles will tell not only what the electrical manufacturer who orders his stampings from a stamping manufacturer should know about stampings, but also what the manufacturer who manufactures his own stampings should know. It is apparent from replies to letters summarized on page 52 that there is room for large savings on stampings. Electrical manufacturers may take advantage of considerable savings just by being more careful in ordering, but the larger savings must come from a close study of the design of stampings and methods of manufacture. Mr. Olsen will go into these problems in detail.

In many cases it will be found advantageous to take one part of a device after another and concentrate on the redesign of this part. It is a proved fact that a large percentage of parts, including those more complicated and costly to produce, may be made much cheaper and in some cases better by a thorough and consistent recheck on all the factors entering into the design, function, method of manufacture, etc., of the part with the idea in mind to reduce the amount of operations, the thickness of material or any of the various factors affecting the cost of the part.

In many devices it is found practicable and advisable to replace heavy, expensive castings with lighter and cheaper stamped parts, and, in the case of complicated castings, two or more stamped parts may be found necessary; however, this procedure generally leads to a better, a cheaper and more easily made product.

Another of the numerous items to be mentioned in the saving of raw-material is the spacing or arrangement of blanks in the strip. Due to the various shapes of blanks, no fixed rule can be mentioned other than to emphasize the importance of figuring the weights of several different material layouts, each having the blanks placed in different locations, until the cheapest arrangement is found.

There is a great opportunity for the use of ingenuity in material layouts, and a thorough and careful consideration of this problem will without exception prove to be advantageous.

After all of the previous items have been applied to a series of parts without any apparent advantage, it may be well to try still another large item which is being employed to an ever-increasing extent; that is the complete redesign of the product for which the series of parts is intended.

If a product is failing to sell "as it used to," the reason can, in many cases, be traced to the fact that it has been standing still and not following the footsteps of other similar products, which in all probability have been steadily improved in function and reduced in price owing to the adoption of modern design and manufacturing methods. This case is found in products a few years old which were designed in the so-called "good-old-days," and the chances are ten to one that the product is designed with heavy castings and all the parts are perhaps twice as large and heavy as they need be.

The same product, redesigned and improved in a modern way would probably be made from a series of metal stampings with a large decrease in manufacturing and assembling costs and at no danger of decreasing the efficiency.

In addition to the above mentioned advantage, it should be noted that such a redesign will tend to decrease the size of the finished product and in many cases will improve the appearance and facilitate finishing, packing, and handling. In many manufacturing concerns there is a policy of periodical redesign of all products, and this procedure is generally a paying proposition.

In every manufacturing plant the raw-material must be stocked and handled, and in some cases it is necessary to rehandle the raw-material several times before it is used. This should be avoided by proper planning and routing of the stock. After the material has been used, the waste must be moved again, and from this it is readily seen that any decrease in waste or scrap may mean a double saving.

What's NEMA Doing?

A department covering activities of the divisions, committees and sections of the National Electrical Manufacturers Association

Nema to Contribute to Support of Local Electrical Leagues

The Nema board of governors, at its meeting at Briarcliff, approved the resolution of the Committee on Electrical Leagues, which provides for subscription to a common fund for the support of the local electrical leagues, said fund to be collected by a board of trustees nominated by the respective electrical manufacturer trade associations and approved by the board of directors of The Society for Electrical Development. The amount to be contributed is to be based, insofar as possible, on a percentage of sales, to insure an equitable distribution of the manufacturers' proportion of the operating costs of such leagues. The funds will be allocated by the board of trustees augmented by representatives of the S.E.D. and the League Council to such leagues having individual membership dues of nominal amount for representatives of contributing national manufacturers, in proportion to the size and activity of the respective leagues.

The president of Nema was authorized to appoint a committee of five to serve as representatives on the board of trustees and to immediately take steps to collect the funds and arrange for the cooperation of such national manufacturers of electrical apparatus, material, supplies and appliances not now members of Nema.

Conferences May Be Arranged with Trade Commission

Attention has been directed to a suggested form of letter drafted by Mr. Neagle to be sent to the Federal Trade Commission if any section desires to request that body to call a Trade Practice Conference. Many of the sections are actively interested in the question of unfair trade practices and Federal Trade Commission trade practice submittals. Arrangements have been made with the Federal Trade Commission, whereby the detailed work of making the application and arranging for the conference can be handled through Nema headquarters.

Jobbers Should Be Charged for Catalog Sheets

The question of whether it is a desirable practice for manufacturers to supply loose leaf catalog sheets to jobbers in large quantities without cost was discussed at a recent Nema meeting. A recommendation was made that the next issue of Principles of Business Conduct should include a statement to the effect that loose leaf catalog sheets sent out to jobbers in excess of those required by their salesmen should be paid for by the jobbers. It was further recommended that the printing of any material which goes into jobbers' catalogs not ordinarily used by their salesmen, should be paid for by the jobbers and not by the manufacturers or publishers.

Cost Accountant Question Discussed at Meeting

The question of employing a cost accountant for Nema was discussed at the meeting of section chairmen at Briarcliff Lodge. It was stated that the board of governors does not feel that at this time it can authorize the expenditure for having a staff expert, but if one or more interested sections would commit themselves to raising two-thirds of the cost for this work, Nema would endeavor to take care of the balance. If any sections are interested, and will communicate with the managing director, he will work out the necessary arrangements.

Nema-N.E.L.A. Committee on Voltages Approved

A joint sections committee representing the switchgear section and the high tension porcelain insulator section, when organized, to discuss standards for insulators to meet the voltages as determined by the joint Nema-N.E.L.A. committee on system voltages has been approved. H. E. Ruggles and W. T. O'Connel were appointed as representatives of the switchgear section.

The section has been conferring with Mr. Hildebrand of the Ohio Brass Company, as representing the high tension porcelain manufacturers.

Standards Committee Rescinds Slate Size Approval

The Standards Committee has voted to rescind the action taken at its March and June meetings, approving sizes of slate submitted by the panelboard and distribution board section, sent to the members of that section in Bulletin 250, page 1, due to the fact there are many sizes of slate at the present time. Consideration of the subject was referred to a joint sections committee on slate simplification, the personnel of which will be composed of panelboard and distribution board, switchgear and industrial control sections.

Joint Committee Will Study Instrument Transformers

The Standards Committee has appointed a joint sections committee to consider the standardization of current ratings of instrument transformers, consisting of two representatives each from the electric measuring instrument section and the switchgear section. The personnel of the committee is as follows:

P. G. Vaughen, G. A. Sawin, representing the electric measuring instrument section; F. W. Patterson, R. A. Neal, representing the switchgear section.

Committee to Investigate Use of Sub-Standard Material

In connection with its activities regarding the elimination of sub-standard material, the flexible cord group of the wire and cable section, Nema, has appointed a committee to confer with The Society for Electrical Development and the N.E.L.A. for the purpose of ascertaining whether attention can be brought to the buyers for large department stores throughout the country as to the hazards of buying and using sub-standard electrical appliances. The committee consists of M. A. Wachstein, Hatfield Rubber Works, Inc.; R. J. Smythe, Lowell Insulated Wire Company; I. S. Galkin, American Insulated Wire Company; R. C. Moeller, Collyer Insulated Wire Company.

Flashover Values Committee Receives New Appointees

H. E. Ruggles, chairman, H. H. Rudd, E. H. Jacobs, W. T. O'Connell and J. S. Lawson have been appointed as representatives of the switchgear section with G. I. Gilchrest and Mr. Hildebrand representing the electrical porcelain section to serve as a joint committee with the A.I.E.E. on divergence of flashover values under different conditions of test and on outdoor flashover values. The Standards Committee has also referred the matter to the wire and cable section and the high tension porcelain insulator section, in order that they may nominate representatives to serve on the joint committee if they are interested.

Board of Governors Approves Specialist Recommendations

The board of governors has approved the recommendation of the Organization Committee regarding the employment of section specialists. The Committee's recommendation provides that the employment of specialists by the sections should be subject to the approval of the board of governors and that at the time such approval is requested, the nature and scope of the duties of the specialists should be definitely outlined. The Committee was of the opinion that these specialists should be under the jurisdiction and authority of the managing director to the extent necessary to insure the coordination of the activities of the different sections employing specialists, and to insure that the work in progress will be at all times in conformity with Nema policies.

Correcting ELECTRIC MOTOR *Troubles*

An outline of the methods and a description of the equipment in the motor repair and manufacturing shop of Joseph T. Fewkes & Company

By WILLIAM M. WALLACE
Associate Editor
ELECTRICAL MANUFACTURING

WHILE the motor repair shop of Joseph T. Fewkes & Company, located at 137 North Twelfth Street in Philadelphia, and one of the largest in that city, is arranged much in the conventional manner, its operation is distinctly different from that of other motor repair shops throughout the country. This is due in large measure to the character of the work performed by this company. Aside from its other activities, Joseph T. Fewkes & Company is an authorized dealer in several kinds of electrical equipment, such as motors, controllers, generating sets, fans, and the like. In addition, the company carries on a small manufacturing business and at the same time services and maintains all kinds of electrical and mechanical devices. Other than this the company is fully equipped for steam engineering work, commercial and industrial wiring and all kinds of electrical installations.

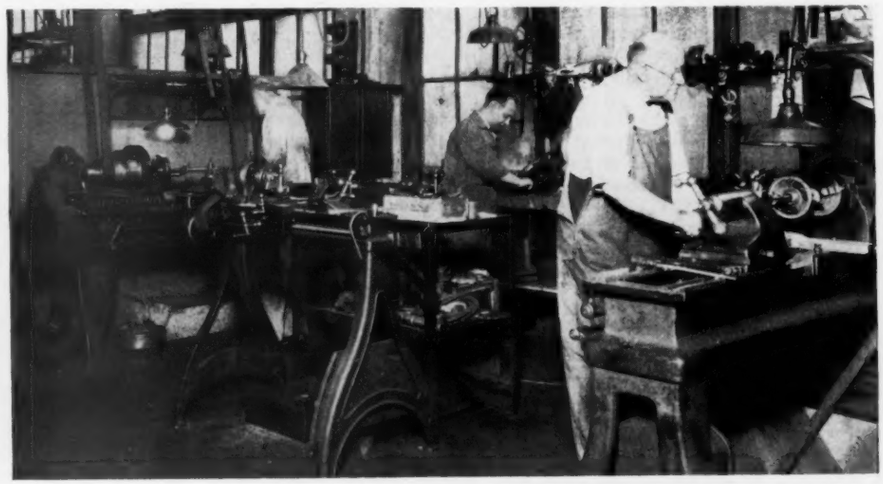
Located in the center of the manufacturing and industrial district of Philadelphia, the company's patrons include users of printing, textile, laundry and many other types of machinery. With such machinery all manner of motors, controllers and other switch gears are used, together with speed reducers and other similar equipment. As a consequence, the mechanics of Joseph T. Fewkes & Company must be something more than simply motor repair men, for their duties include the maintenance of all of this equipment, besides the power and mechanical devices used in elevators and many other manufacturing enterprises. In fact, the company is fully fitted with both equipment and skilled workmen to enable it to undertake the maintenance or reconditioning of any type of electrical or mechanical mechanisms.

Joseph T. Fewkes, president of the company, first took up electrical work in the general contracting business some thirty years ago. After a few years he became employed in the electrical repair department of a street railway company, where eventually he was placed in charge of all work. Later he returned to commercial motor repair work and for several years was engaged in steam engineering.

With all of this varied experience he, with some associates, established in 1902, the electrical business known for a time as Whalen & Crosby. This business continued until 1908, when the name was changed to that of Fewkes & Whalen, Inc., which continued to function under that name until 1915, when Mr. Fewkes withdrew from the older organization and formed the present company, of which he is head, with Harry E. Murty, treasurer, and Laura V. Fewkes, secretary.

The first shop of the present organization was located at 124 North Twelfth Street, but as additional space was required the company moved to its present location in 1921. This shop is on the first floor of a large industrial building, and as has been stated, is fully equipped. It is essentially divided into three separate sections or departments. One of these, fittted with benches and all other necessary equipment is known as the motor repair department. Another section is arranged with lathes, drills, shapers and other machine tools and is the machine shop of the company. The third section is that in which all work on coils is performed.

It will be noticed that there is no separate test department,



A section of the machine department of the Joseph T. Fewkes & Company motor repair and manufacturing shop in Philadelphia. This view does not include several other large machines of different types that are required in such a shop as this. Notice the clean and orderly arrangement of the shop and the modern tools with which it is equipped

as is the case in most motor repair shops. This is because all testing or electrical equipment is done on the bench where it is repaired. There is, of course, a full line of test equipment in the shop, with the usual control board and current supply of any desired power. This is wired directly from the control board to each of the repair benches where suitable connections are provided, with the necessary auxiliary control equipment, for testing any kind of electrical device.

Such practice as this affords unusual flexibility in connection with motor repair work. It makes possible the testing of the many different pieces as they are assembled when this is desirable. It eliminates the necessity for moving the repaired device to the test rack, as is often done, and should further adjustments be needed it also eliminates the moving of the device back to the repair bench. Furthermore, it does away with the necessity for the use of a man for conducting tests. There is also the element in the saving of time, for under this method the man at the repair bench can go right ahead with other repair work while a motor or generator is being "run in," whereas, with a man at the test rack there is little more he could do other than stand and watch the apparatus under test.

Large Storeroom Maintained

IN the coil winding department of the shop there are several different types of machines suitable for making any kind of coil. And operated with this section is the usual insulating material dipping tank and baking oven. This, of course, is in a part of the shop where it is easily accessible and where it is least liable to cause fire hazards. Included in the coil winding department is a section for preparing sheet insulation and all wire for the different coils is stored conveniently near the department, rather than in the storeroom, which is in another section of the shop.

Since Joseph T. Fewkes & Co. are dealers in so many different kinds of electrical equipment, the storeroom must of necessity be quite large. All of the stock of this company is not carried in the storeroom in the shop, however, for in addition there is a large warehouse where all of the heavier equipment is stored. The materials in the storeroom at the shop include all of those necessary for any kind of repairs to electrical, mechanical or steam equipment. These are not carried in large quantities, but there is always sufficient on hand to accommodate requirements for thirty or sixty days.

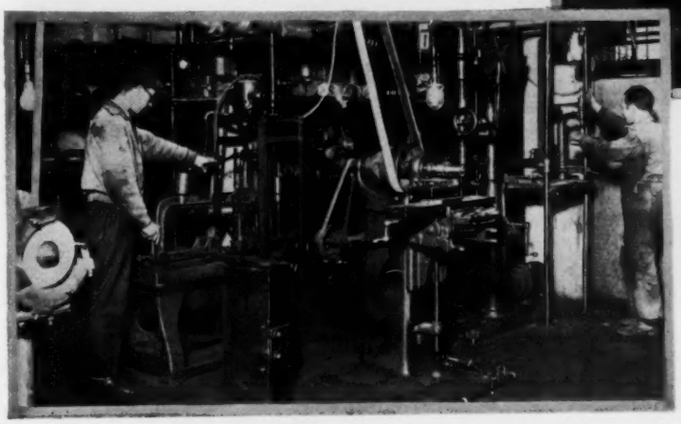
Since in the motor repair business bushings, bearings and the like play an important part these are carried in considerable quantity, and one department of the storeroom of which Joseph T. Fewkes & Company is particularly proud is that in which repair parts for the older types of electrical equipment are carried. Here are to be found bushings, bearings, brush holders and many other parts too numerous to mention that are applicable to many of the older types of electrical devices that were built years ago. Of course, with such a great amount of materials on hand it is essential that they be under the care of a capable attendant. His duties are similar to those of any storeroom attendant, including the keeping of records of all stock on hand, duplicates of which are maintained in the office of the company.

Shop Work Is Specialized

IN this respect it should be mentioned that the active management of the shop and office of the company are under the supervision of Harry E. Murty. Mr. Murty is a man of long experience in the electrical business, who entrusts the operation of the shop proper to a foreman, likewise of long experience in electrical work. This foreman is in direct charge of some twenty to thirty workmen, engaged at all kinds of jobs, varying from the rebuilding of a small fan motor, the construction of a generating set or making some kind of mechanical device. Many of these men work both in the shop and on other work outside the plant. In addition to the shop force, and with the assistance of Mr. Fewkes, who is very active in the business, there are two sales engineers and one wiring or construction superintendent who handle and supervise all work outside the plant. This, as is the usual case, includes estimating on new work, planning jobs, and the execution of contracts.

Since there is little new that can be said with reference to reconditioning or installing electrical equipment, it should be of interest to describe the shop methods of Joseph T. Fewkes & Company with respect to the records of time and materials and the manner in which the organization functions. To begin with, and except for the apprentice boys, all of the workmen are experts in their respective lines. For this reason the workmen are divided into groups; each group or class of men being assigned to some specific duty. All work is specialized in that one group works on motors and generators, another on controllers, another as machinists, etc.

But, as is often the case in many shops, there are times when there is not sufficient work of one kind on hand to keep one group engaged. At such times as this the men do general work for which they are best fitted. As an example,



TWO additional views in the shop of Joseph T. Fewkes & Company. At the left is a scene in another section of the machine shop while the illustration above shows the coil winding department. In this department is all the equipment needed for making any kind or type of coil required in electrical equipment

should the occasion arise, men engaged on controller repairs might be required to assist in the dismantling or stripping of motors, or men in the motor department might be asked to assist the group on controllers, so that at all times there is ample for each to do.

Then, that there may be an accurate record of the work performed by each workman, all of them are supplied with small books in which they record their time and what they were doing. These books are carefully checked by the shop foreman, the time records are copied on time sheets, and the books are filed for reference purposes.

If materials are required on the job this too, is entered in the workmen's books, from which it is copied on the office records. Of course, requisitions are issued for the materials before they can be withdrawn from the storeroom, so that the storeroom attendant also has a record of all materials used.

Work is Handled on Shop Orders

IT can easily be appreciated that extreme accuracy is essential in the accounting of materials so that the proper charges may be made both against the customer to whom it is sold and to the supply on hand. Likewise, is it essential that time records be accurate, to insure proper billing against the customer and the proper charges to shop or labor expense; both being material factors in determining operating costs or more commonly called overhead, without accurate knowledge of which no enterprise can hope to succeed in this age of intensive competition.

As is the case in many other shops, the Joseph T. Fewkes & Company uses what is termed a shop order. There are three copies of this and as work is received in the shop each job requires a number. Two copies of the shop order go into the shop, bearing the job number; one copy being for the foreman's personal record file and the other to be returned to the office with records of all time, materials and accounts of the work actually performed on the job.

In the office are kept what are known as cost sheets. These are serially numbered and are used for compiling the amount of the bill against the customer. Information for filling them out is taken from the shop order and includes time, materials, workmen's expense in the field, if any, cartage, overhead and other items entering into the cost of the job. Once these are filled out the bookkeeping department is able to bill the customer for the correct cost of the job, after which the shop order, the cost sheet and all other data connected with that particular job is placed in a carefully labeled envelope and these are filed for five years, as permanent records of that one transaction.

In conclusion it might be said that Joseph T. Fewkes and his associates in business have built up that business through strict adherence to the policy of efficient and satisfactory service to their patrons. Because of this many of the first customers of the old and the present organizations are still on the books as patrons. Another established practice of Joseph T. Fewkes & Company is that it will under no circumstances have anything to do with the selling or exploiting of any device, no matter what its nature, until that device has actually proved its merit by long and continued usage. In this manner it feels that it is protecting its customers and because of this practice the company has built up a reputation for honesty and fair dealing.

As another favor to many of its patrons, the company makes a practice of maintaining service at night and even on holidays, so that none of its customers need experience more than the necessary delay through any break-down or failure, no matter when it occurs. This one feature of service alone is of inestimable value, both to Joseph T. Fewkes & Company and its patrons as well.

It should be understood that Joseph T. Fewkes & Company does not limit its activities to Philadelphia alone, as many of its largest customers are located in nearby cities. In the way of manufacturing the company confines itself largely to the production of only such devices as are of an electrical nature, although it is adequately equipped with the necessary facilities for making almost any kind of mechanical equipment, and while the company does not make a specialty of steam engineering work there is always a full stock of materials on hand to permit of making any repairs to steam equipment. This is done largely in connection with electrical maintenance work, and of course, with some initial installations of electrical equipment, when this equipment has some connection with steam engineering.

Since the company is an authorized dealer in many kinds of electrical equipment, and as this business is quite extensive it is handled separately from that of manufacturing or repairing motors. Complete records are on file in the office of the company, in the shop storeroom, and at the warehouse, showing at all times just what devices and materials are in stock. These records are kept on cards, for convenience, and as new materials are received or are delivered they are checked off on the cards and in this manner a perpetual inventory is maintained. Among the various devices carried in stock might be mentioned motors, under twenty-five horsepower, of practically all commercial sizes such as variable speed and other types for either A. C. or D. C. current; fans of all types; all manner of controllers and repair parts, as well as many other devices of a smaller nature. Of course there are also all kinds of wire and many wiring appliances.

The motor repair section of the Joseph T. Fewkes & Company is adequately equipped with all of the facilities for making repairs to any kind of electrical devices. Notice that testing is done at the bench rather than at a test rack, as is the case in many other motor repair shops of this kind. However, it affords a very convenient arrangement

Mechanical Transmission for Motor Drives

*This is the third of three articles having to do with the design and maintenance of the several different types of transmission for motor drives**

THE best position for silent chain drive is with its axis inclined about 20 deg. with the horizontal, and with the larger sprocket at the top. With silent chain, unlike belt drive, the top should be the driving side. With such an arrangement there is little danger of the chains fouling, that is the two sides of the chain striking each other; the slack on the bottom side of the pinion allows easy disengagement; the weight of the chain does not come unduly on one bearing.

The weight of the chain together with the pull to transmit the power puts such a strain on the bearings that some provision may be necessary to take care of this. Where the pitch diameter of the sprocket pinion is less than half the diameter of the standard pulley an outboard bearing should be used. If reversing drive is required, the number of teeth ordinarily used should be increased about 25 per cent to take care of the greater strains.

Vertical drives are even worse than those with belts, as the weight of the chain must not only be carried entirely by the top bearing but the chain tends to hang away from the lower wheel, and particularly where the smaller wheel is underneath, a small amount of slack will cause the chain to hang free. The stretch of the chain is greater, too, consequently some means must be provided for taking up slack.

Chains stretch after operation. To compensate in part for the stretch as well as to make removal and replacement easy, a sliding base should be provided if the direction of drive is such as to allow tightening by this means. Where it is impossible to provide adjustment, a chain wider than that necessary to transmit the power should be selected.

If the chain is run in air, the chain may be oiled by a large drip-feed lubricator which feeds to the inside of the chain near the pinion. If such a drip lubricator is not used, the chain should be lubricated every few days using a brush to apply the oil. In any event the chain should be encased for protection to the operator as well as to the chain.

It is better to run the chain in an oil bath because of the greater ease in keeping the chain lubricated. If the case is made of substantial material (about 12- or 14-gage hot-rolled steel) with welded corners, a casing that is both dustproof and oil-tight is secured. Casings are ordinarily made split to facilitate installation and maintenance. The chain and sprockets should be slightly submerged in the oil. If the motor shaft is considerably lower than the driven shaft, however, the oil would pocket in the smaller end. In such cases the disk type, as shown in Figure 16 is used. If a casing provided by the chain manufacturer is used, the oil need be changed only about once a year. If a home-made case is used it is better to change the oil every three or four months.

Whether or not the chain is run in oil or in air, a good grade of medium-heavy, pure mineral oil should be selected.

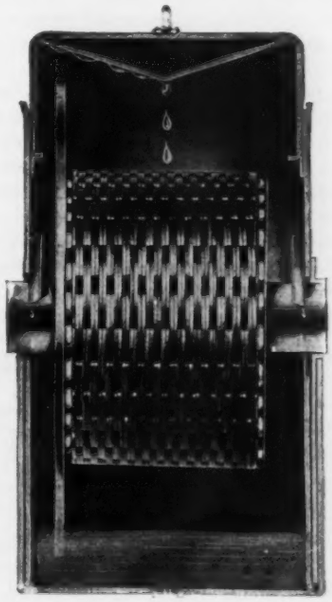


Figure 16. Disk-Type Lubrication for Silent Chain Drive

Specifications for Ordering Chains

1. Type of machine driven.
2. Maximum horsepower transmitted.
3. Revolutions per minute of driving shaft.
4. Revolutions per minute of driven shaft.
5. Bore and size of keyway on driving and driven shafts.
6. Maximum wheel diameter and width permissible.
7. Length of motor shaft extension.
8. Approximate center distance.

A sketch showing the angle of drive, and noting the driving sprocket and direction of rotation should also be furnished.

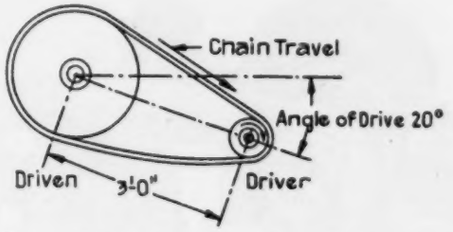


Fig. 15. Layout of Chain Drive

* The information contained in this, the last of three articles, published in ELECTRICAL MANUFACTURING was abstracted from data published by the Small Motor Division, Industrial Department of the General Electric Company, River Works, West Lynn, Mass.

Graphite greases are not desirable as they leave deposits on the surface of the chain which prevent the lubricant working into the joints. Inferior grades of graphite are apt to contain grit which tends to wear the joints. Pure graphite grease kept below 180 deg. Fahr. will give satisfactory results but the oil recommended previously will in general be more satisfactory.

Silent chain has an advantage over other forms of chain drive in that all the pressure does not come on one tooth even after the chain has stretched. Instead the chain simply rides higher on the sprocket teeth to compensate for

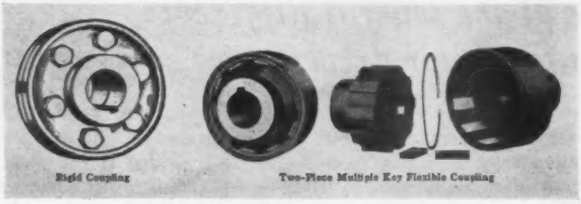


Figure 17. Rigid and Flexible Type Couplings

this stretch. After the stretch becomes too acute, it can be compensated for by putting in new and larger pins, which may be done by the maker, or the proper pins may be secured by sending the maker samples of work links, selecting one from the side, and one from the middle of the same row of links, and having the pins inserted at the plant.

The easiest method of cleaning a chain consists of removing it and sousing it in kerosene. If impossible to clean it by this means steam may be used for cleaning. In either case the chain is thoroughly re-oiled or regreased if run in air. Where oil-immersed chains are used, the oil in the case should be removed and replaced by fresh oil as conditions warrant.

Direct connection is employed either on high-speed machinery where the operating speed corresponds to the full-load motor speed, or on low-speed machinery using slow-speed motors, where the cost of reduction units would more than outweigh the difference in cost between high- and slow-speed motors.

Direct connection gives a positive, noiseless and mechanically efficient drive occupying minimum space and re-

Figure 18. Method of Reversing with Friction Drive

quiring practically no attention. The coupling itself is comparatively inexpensive and easily applied. It is used largely on motor-generator sets, sugar and laundry centrifugals, blowers, centrifugal pumps, etc.

The two general types of couplings are the rigid or solid flange coupling, and the flexible coupling. Figure 17 illustrates one type of each. Flexible couplings are made in an almost infinite number of forms. Some of the most common are: key; bushed pin; laced; cantilever; all metal (various types).

It is always advisable to use the solid flange coupling where the machines can be accurately and permanently lined up. This practically means that the motor and driven machine must be mounted on a common, rigid bedplate. Flexible couplings are not intended, and cannot be used, as a substitute for careful alignment. High-speed machinery in particular suffers from faulty alignment by vibration, worn couplings and bearings, and deflection of the shafts.

The long-hub, solid flange coupling is considered standard and should be used ordinarily for rigid connection under conditions as outlined in the preceding paragraph. The short-hub type is of the same construction but is intended to be used only where the shafts are coupled close to the bearings so that no load other than torsion is carried by the coupling, or where the shafts are abnormally large.

The selection of the proper coupling should be determined by calculation, and not by the method of choosing the bore corresponding to the shaft, though in most cases couplings selected by shaft size will be more than amply to carry the load. Manufacturers' recommendations should be followed explicitly. Care should be taken to select a coupling of sufficient capacity to take care of not only the normal load, but also of any unusual shock loads peculiar to the driven machine.

In ordering couplings specify:

1. Kind of machine being driven.
2. Whether rigid or flexible coupling is wanted.
3. Horsepower transmitted. (Maximum peak load.)
4. Revolutions per minute.
5. Bore and keyway, each end. (Give bore to thousandths if finish bore is desired. If not specify rough bore.)
6. Length of shafts available for mounting.

Friction drive is of little importance but some forms of machinery still employ this form of drive. It is applicable where small amounts of power (½ hp. and less) are to be transmitted; where it is desired to change the velocity ratio or the direction of rotation during motion; or where the reduction ratio would preclude the use of gearing.

The construction employs a small iron disk faced with fiber, straw, leather, paper, cork, or wood, bearing against the side of a larger disk which is usually made of cast iron, aluminum, or type metal. The disks are so mounted that the smaller can be moved radially along the side of the larger, changing the effective radius and thus the ratio of reduction thereby, or the disk may be moved past the center, thus reversing the direction of rotation.

The following formula gives the maximum horsepower that can be safely transmitted by friction drive:

$$\text{Hp.} = \frac{f}{1000} \times WDN.$$

when D = Diameter of driving wheel in inches.
W = Width of face of driving wheel in inches.
N = Revolutions per minute of driver.
f = Coefficient of friction.

There are two general systems employed in rope drive, the English and American. In the first-named system each rope is complete in itself with a separate rope for each groove. The American system uses one rope wound continuously from one set of grooves to the next and fed back to the first groove again by idler pulleys. One of these idlers is usually equipped with sliding bearings and a coun-

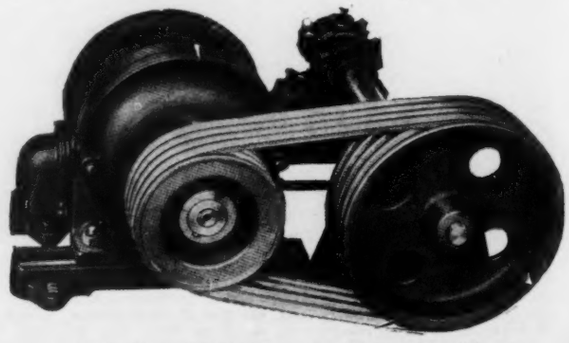


Figure 19. Illustration of a "Texrope" Drive

terweight to maintain constant tension on the ropes. The English system requires more splices and it is difficult to maintain even tension in all ropes; the American system forces a complete shutdown if the rope breaks. Neither system is widely used except for the transmission of large powers between points somewhat remote from each other.

Manila rope of good grade is the common rope used,

Table VII—Values of Coefficient of Friction for Various Materials

Surface of Driving Pulley	Coefficiency of Friction		
	On Iron	On Aluminum	On Type Metal
Straw fiber	0.255	0.273	0.186
Leather fiber	0.309	0.297	0.183
Tarred fiber	0.150	0.183	0.165
Sulphate fiber	0.330	0.318	0.309
Leather	0.135	0.216	0.246
Cork composition	0.210	.....	.....
Wood	0.150	.....	.....

although specially made steel cable has met with considerable success. With full-stranded cable and hemp or rubber center, high flexibility is secured. Manila rope runs in V-shaped grooves which pinch the rope slightly, steel cable must be run in rounded grooves of the same diameter as that of the cable.

Small pulley size has a greater effect on rope drive than on belt drive. The following figures will give an idea of the proper relative size of rope and pulley:

1¼-in. rope not less than 3 ft. diam. pulley.
1½-in. rope not less than 4 ft. diam. pulley.
1¾-in. rope not less than 5 ft. diam. pulley.

Figure 20. Adjustable Speed Transmission Unit

2-in. rope not less than 6 ft. diam. pulley.

A rough calculation to use is that the pulley diameter should be about forty times the rope diameter.

Based on a tension of 200 lb. per in. of rope diameter the following formula will serve in calculating horsepower to be transmitted by manila rope.

$$Hp. = 0.014S \times d \times D \times N$$

where S = Number of ropes or wraps.
d = Diameter of rope in inches.
D = Diameter of sheave in feet.
N = Revolutions per minute.

Rope drive should not run faster than 6000 ft. per min., and the tendency seems to be to use more pulleys and ropes and a lower rope speed.

Texrope drive is essentially a combination of belt and rope drive, consisting of a driving and driven sheave grooved for a multiple of special V belts. Its chief application lies in short center distance drives where the qualities of silence, smooth starting, acceleration, and running are desired. It requires no lubrication, and it is elastic enough to be shock absorbing. Figure 19 shows the general construction of a Texrope drive.

For a given horsepower and reduction ratio Texrope drive will not, in most cases, transmit the power with as small center distances as will chain drive.

Orders for Texrope drive may be made through the General Electric Company, specifying:

1. Horsepower to be transmitted.
2. Speed of motor and driven shafts in revolutions per minute.
3. Center distance.
4. Whether key seat or clamp hub is desired on sheaves.
5. Diameter, keyway size, and length available for mounting on both motor and driven shafts.

The principal field for the use of adjustable speed transmission, one type of which is illustrated in Figure 20, is in securing adjustable speed operation in place of cone pulleys, shifting gears, etc. Where only alternating current is available, there are certain applications where this unit may be used with constant speed motors in place of adjustable or adjustable varying speed motors. The horsepower delivered at the driven shaft (B, Figure 20) depends upon the speed, so that to deliver a given horsepower at all speeds, a unit large enough to give the desired horsepower at the minimum speed must be selected. Either hand or automatic control may be obtained.

A unit drive complete with transmission, motor base, motor, chain, and sprockets may be furnished, or if the customer has the motor and connections, then the transmission can be furnished with the motor base ready to receive the motor. In making inquiries specify:

1. Kind of machine driven, and horsepower required.
2. Diameter and belt width and maximum and minimum speeds desired (r.p.m.) on driven pulley if machine is belt driven.
3. Number of teeth and maximum and minimum speeds desired, (r.p.m.) on driven gear or sprocket if machine is chain or gear driven.
4. Is unit drive complete with transmission to be furnished, or will unit be belt driven from motor?
5. If transmission is to be belt driven from motor; hp. of motor; motor speed (r.p.m.); diameter and belt width of motor pulley.
6. Will transmission rest on floor or ceiling?

Sales Engineers Know Product

(*Continued from page* 42)

Speak English clearly or with a foreign accent?
What languages do you speak?
Is anyone wholly or partially dependent upon you?
What forms of recreation do you indulge in?
Do you excel in one or more of them?
Are you a member of any State volunteer organization?
What per cent of your college expenses did you earn?

Students, who are selected for engineering work at the factory, are given the same course as men who expect to follow sales work, but the shop course is omitted. They are immediately assigned to engineering duties of such a nature that they are continually brought into contact with the manufacturing departments in the shop. Such an arrangement readily affords an opportunity to become acquainted with the product and methods of manufacture, without actually taking the shop course.

Circuit Breaker Manufacture Requires Extensive Facilities

(*Continued from page* 36)

To do this requires an extensive equipment of many different types and kinds of manufacturing machinery throughout the plant.

The production of U-Re-Lites began in 1919. They are primarily I-T-E circuit breakers enclosed in insulated steel boxes and are widely used for the protection of electric motors and power or lighting circuits. This is accomplished by an automatic mechanism arranged to open the circuit in the event of excessive current flow. The U-Re-Lite is in a sense an electric safety valve, designed for protecting electrical circuits of 550 volts or less, A. C., or 250 volts or less, D. C. The mechanism is mounted on a slate base, enclosed in a metal case, on the front of which is mounted a handle for the closing or manual opening of the circuit breaker element.

Since the design of these enclosed circuit breakers is generally similar they can be manufactured in quantities, in the form of what is known as "straight line mass production," which is not possible with the other types made by the company. Many of the parts for these breakers are produced with the same machines and equipment that is used for the other types. The slate panels, for example, are made on the fourth floor of the larger plant; the metal cases are made on the same presses that produce I-T-E breaker parts, while the smaller pieces are manufactured along with I-T-E parts in still other departments.

All of these many pieces are assembled in units, after which the different units are assembled into complete circuit breakers. As the work is now arranged the cases are put together on one floor; the smaller parts, such as contacts, handles and the like are assembled in another department. These are then attached to the slate bases and then the cases are put on. After the final assembling operation each U-Re-Lite circuit breaker is carefully inspected and tested before it is placed in service, this being a strict policy with the I-T-E company that every device must be made to accomplish, under actual conditions, the purpose for which the customer intends to use it before it leaves the plant.

Overlapping Association Activities

(*Continued from page* 24)

quencies, whereupon losses would become negligible, if not nil.

No section of the country is or can be independent in trade of the rest of the nation. No branch of the allied industries is a self-contained unit. Nor can it afford to ignore its inter-relationship with the allied industries in the matter of credits.

If a section or a branch lacks faith in the solidarity of the allied industries, is it not wilfully blind to the community of interests? Is there not a natural oneness and fine fellowship, which, when accepted and acted upon, spell protection, progress and prosperity for all?

If a section, or branch, claims for itself as a matter of right, complete economic freedom of action and separation, cannot all sections and branches claim the same right? If they all do the electrical and allied industries will be thrown back to the days and doings of Ishmael.

The allied industries created and control a mutual protective organization for the cooperative exchange of credit facts and ledger experiences. The allied industries are competent to determine the character of credit service now suited to their needs. The present service of the N.E.C.A. is designed, by the trade itself, to cover its credit requirements. The setup of the N.E.C.A. is sufficiently elastic to accommodate its functions to the wishes of every division, branch and section of the allied industries.

The servant is subject to its master. In the interest of trade economy, solidarity, protection, progress, profit and welfare, should there not be a union of credit forces, functions and factors, managed and operated for the exclusive benefit of the allied electrical industries, working through the National Electrical Credit Association?

Coordinated Selling Brings Success

(*Continued from page* 27)

To enumerate the many pieces of literature made available and tending to promote the sale of electric refrigerators would be like issuing a catalog of a library. They are designed to meet every conceivable argument. To supplement this ammunition Rex Cole, Inc., issues numerous helps from time to time capitalizing upon local accomplishments. The manner in which this material is employed is carefully thought out so that it bears a definite relation to the general scheme.

Household economics activities constitute a highly important element in the promotional structure. Their function is, by merchandising the many possibilities of electric refrigerators, to bring the user to a full realization of all the benefits accruing from her investment, and to awaken in the mind of the prospect by actual demonstration what the purchaser of an electric refrigerator is offered in enjoyment, economy and ease and variety in meal preparation. The face-to-face contacts resulting from the demonstrations is a potent aid to the creation of a wider and deeper public consciousness for proper refrigeration.

Window displays, billboards, signs, expositions and a vast assortment of sales helps serve to round out the sales promotion activities of Rex Cole, Inc. Employed with discretion and according to a well prepared plan they are an indispensable part of the selling task. Day by day they are strengthening and extending the foundation of public favor for the electric refrigerator upon which the salesman is ever able to erect a loftier and loftier structure of sales.

Coordination of all selling activities is the keynote of General Electric refrigerator sales success.

Maintenance of Electric Trucks Is Important

(*Continued from page* 30)

will be kept as low as possible. The installation of ampere-hour meters on the truck is also to be recommended for the same reason that a gasoline gauge is provided on an automobile.

The above rules are easy to follow, impose less of a burden than the majority of equipment and when followed will yield greater returns in long life, capacity and endurance than almost any similar effort. The storage battery and the electric truck have a reputation for ruggedness which has led to the neglect and abuse of the equipment. However if the storage battery and the electric truck are given the little attention which is required the equipment will pay even further dividends than it does now.

Hard Rubber—Its Uses in the Electrical Industry

No. 10 of a Series of Articles on Common Materials

Rubber in several different forms has always had a number of uses in the electrical industry, but in recent years other products are supplanting it

By William Crawford Hirsch

WHILE hard rubber no longer holds the dominant position among molded insulating materials that it did a score of years ago, it is still an important factor in the electrical industry's requirements. The fact that many hard rubber manufacturers are adding equipment for the molding of phenol-formaldehyde insulation indicates their conviction that, side by side with the more modern types of molded insulation, there will always be a certain demand for hard rubber. In the early part of this century hard rubber, because of its mechanical strength, displaced porcelain in many uses, and gradually attained a leading place among molded insulating materials. Recurrent flurries in the crude rubber market, which at times sent prices to fantastic heights and always caused more or less uncertainty among electrical manufacturers as to what they would have to pay for their hard rubber requirements, were perhaps to a certain extent responsible for some electrical users turning to shellac and other compositions. The relatively low heat resistance of hard rubber may have been a contributing factor in some cases.

Most important of all reasons why hard rubber has, at least for the time being, yielded first place to other molded insulating materials is the fact that the rubber industry has found so tremendous an outlet for the product of rubber-yielding trees in automobile tires, that research in most other directions has stood still. The reasons most frequently cited for the onward march of other materials and the standing still of hard rubber are that much more time is consumed in producing the latter, especially in the curing process, and the limited color range that hard rubber products afford. Aside from the sulphides of antimony, cadmium and mercury, the color chemist has so far not furnished the rubber industry with bright dyes that will withstand the action of sulphur and heat in the vulcanizing process, so that black, red, and mottled red are virtually the only colors available in hard rubber. Difficult as the solution of these problems may seem, one can not help wondering whether, had it not been for the windfall which the automobile brought to the rubber plantation owners, progress in overcoming the obstacles to the use of rubber in other lines of industry would not have been much more pronounced. Rubber possesses so many virtues: light weight, high tensile strength, toughness, flexibility, elasticity, low absorption of moisture, resistance to most chemicals, general efficiency as a non-conductor, and machinability, that it will always come in for consideration when the choice of molded insulating materials comes up for discussion.

The recent death in London of Sir Henry Alexander Wickham, who first brought with great difficulty, and in the face of Brazilian Government opposition, the seeds of wild rubber from the upper reaches of the Amazon to Kew Gardens in London in 1876, revived popular interest in the history of rubber. The 7000 rubber seed trees brought to London by Sir Wickham were planted in greenhouses and later shipped in glass cases to the East Indies. In 1927, the East Indian plantations, extending over Ceylon, India, Burma, Borneo, Malaya, Siam, Indo-China, Java Sumatra, and the Pacific Islands, with a total rubber acreage of 4,500,000, produced more than 600,000 tons, and this while the so-called Stevenson Plan, restricting output, was in force. The Stevenson control measure was abandoned in 1928, its tangible result having been that the Dutch East Indies planters who did not join in the restriction gained the supremacy in production, the output of the British East Indies undergoing a sharp decline. The United States is the world's largest consumer of rubber, taking approximately 70 per cent of the crop. American interests are now making efforts to add appreciably to the world's supply by production in Liberia and other parts of the world.

A tapper removing the dried strip of rubber from yesterday's cut in the bark. This is only one of the many processes in obtaining crude rubber for the market before it can be used commercially

The milky juice of the rubber trees, known as latex, is congealed either by smoking or treatment with acetic acid. It is cleaned and otherwise processed either before it is shipped from the plantation factory or after it arrives here. Common forms of crude rubber are ribbed smoked sheet and crepe, a sort of biscuit shape. Following further preparatory treatment, the crude rubber is dried and ground. To obtain desired properties, several grades of crude rubber may be blended, and to this may be added a certain percentage of scrap rubber which has been chemically regenerated. Hard rubber waste, reduced to fine powder through successive grinding operations, plays an important role in the compounding of certain hard rubber mixes, especially those intended for the manufacture of battery boxes and separators. Certain minerals may be added as fillers and to accelerate the vulcanizing process, care being taken to avoid gritty substances when the article to be formed is to have a smooth surface.

The Goodyear Vulcanizing Process

THE vulcanizing process, accidentally discovered by Charles Goodyear, when in 1839 he happened to spill some rubber and sulphur on a hot stove in his kitchen laboratory, consists of a chemical combination of rubber with sulphur, the extent to which this union takes place depending upon the temperature to which the mass is heated and upon the duration of the heating. The underlying principle of vulcanization is the slow application of heat in chambers.

Hard rubber molded insulation averages a 30 per cent sulphur content. Sulphur content ranges from 5 per cent in fine tubing up to as high as almost 50 per cent in certain sheets. In battery jar rubber about 14 per cent sulphur is used in the mix. The vulcanizing temperature used in the making of hard rubber molded insulation approximates 300 deg. F.

Molded rubber insulating parts are formed in presses. The material is cut into shapes approximating the outlines of the article to be formed, pre-formed so to speak, and placed into the depressions of the die which has been previously heated on a steam table. The two halves of the die are then securely locked together. Then comes the vulcanizing process. The length of time required for this "curing" process depends on the character of the batch and the temperature, but it may be emphasized that the time required for "curing" is one of the important cost factors.

Aside from the special molded insulating shapes, hard rubber is obtainable in sheets 20 x 48 in. and 1-64 to 1 in. thick; in rods ranging from 1-8 to 3 in. in diameter; and in tubing of from 1-8 to 1 3-8 in. inside diameter and 2 ft. in length.

Rubber Resists Chemical Action

METAL inserts, such as contact pieces in magneto distribution parts, can be readily taken care of, but they should be either nickel-plated or tinned, so as to prevent the sulphur in the rubber from corroding the copper. When hard rubber parts are mounted on metal bases, the material's elasticity will be found a valuable preventative against cracking. With reference to surface creepage between neighboring metal parts or to ground, rubber's non-carbonizing property is especially valuable. In storage battery jars, boxes, and separators, rubber's resistance to chemicals, especially to sulphuric acid is an important asset.

While the heat resistance of hard rubber does not exceed 200 deg.F., it has the property of healing up after an arc has broken down its surface, without leaving a path of carbon.

Tolerances for hard rubber molded insulating parts should be rather liberal. They are, however, easily machined to size. Small lots can be produced relatively cheap by the use of tin alloy molds cast from steel matrices. High tension power line insulators of hard rubber for distributor rotors and blocks, collector spools, antennas, etc., are usually made in steel dies that eliminate the necessity of machining.

When hard rubber contains a considerable percentage of free sulphur, it will turn green. This phenomenon is known as blooming, and in no wise affects the strength or other properties of the rubber. Some manufacturers go so far as to say that it is a sure indication of a properly cured rubber, but inasmuch as they have received numerous complaints in the past on this score, they have taken pains to eliminate it.

A good deal of hard rubber has found its way into radio receiving sets. Hard rubber panels were favorites for a long time. Much rubber tubing, with an outside diameter of from 2 to 4 in. and a wall thickness of 1-8 in., is used in inductance and radio frequency coils, variometers, variocouples, etc. It comes in lengths of from 3 to 30 in. Dials, knobs, sockets, rotors and stators are a few of the forms in which molded hard rubber insulation finds employment in radio receivers. Head phone sets and loud speakers also call for much hard rubber. Hard rubber, because of its flexibility, possesses a decided advantage over other forms of molded insulation in head phone sets, whether used in connection with the radio or telephone. Low phase angle difference, low dielectric constant, high resistivity and low absorption of moisture are some of the properties stressed in behalf of hard rubber's use for radio parts.

The selling price of hard rubber molded insulation is, of course, based to a large extent on the market price of crude rubber. In spite of the restrictions imposed upon exports by the Stevenson plan, the market slumped long before announcement was made that all restrictions would be lifted. In December 1928, the nominal quotations for spot rubber in the New York market was 18c., compared with $1.20 three years ago. Stocks of crude rubber in London, Liverpool, as well as the United States are considered heavy. With the virgin product selling at 18c. a pound, a tapering-off is expected in the production of reclaimed rubber which costs from 6 to 7c. a pound to produce and two pounds of which are generally considered as replacing one pound of virgin material.

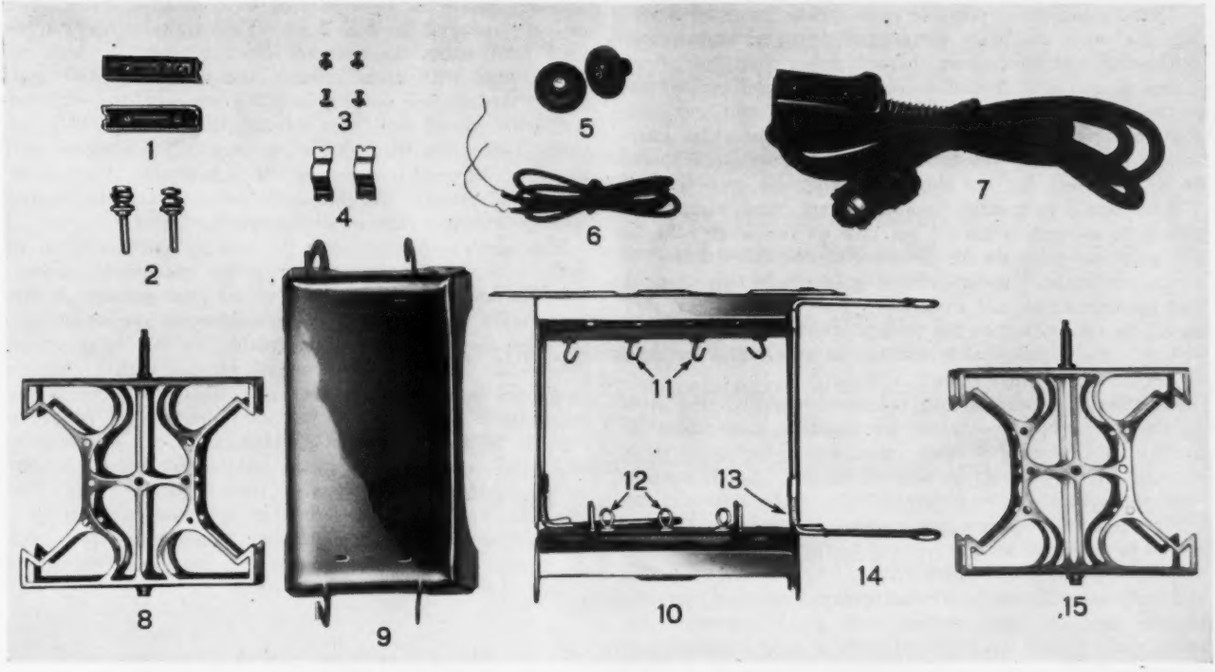
Wages Affect Rubber Production

WHILE one hears from time to time by way of London or Singapore that there is danger of the tappers refusing to work any longer at the prevailing low rate of wages, majority opinion inclines to the view that for some years to come considerably more rubber will be produced than consumed. It is quite unlikely that the world's tire and tube consumption will increase henceforth at anything like the pace that has so far been in vogue. What rubber obviously needs, is to hold its old markets and to add new ones. Some years ago the British rubber growers offered prizes for suggestions of products in which rubber might find additional outlets. Hard rubber was for years a standby in the electrical industry and still is in many uses, but to hold its position, the industry can not ignore the challenge of intensive scientific research that has characterized the development of the more modern molded insulating compounds. This is not a matter for the fabricators of molded insulation who can adapt their equipment to any raw material. It is, however, the most important task that confronts the plantation interests, their associations, and the colonial governments that are deeply concerned with the prosperity of the rubber industry.

Too much cannot be said in favor of experiment and research looking toward the finding of new and more diversified uses for rubber. Many other industries whose products were being supplanted have through research found new uses for their goods. In some instances, too, where the development of new applications for certain products was necessary to the continuance of that business, research has usually found a way, and so may it be in the case of rubber.

Toaster Components

Steel, mica, molded insulation, hard rubber, brass, resistance wire, asbestos and fibre are the raw materials used in the electric toaster



ELECTRICAL MANUFACTURING *acknowledges the assistance of The Fitzgerald Manufacturing Company, Winsted, Conn., in the preparation of the above illustration of electric toaster components. According to figures compiled by the Bureau of Statistics, Department of Commerce, there were 735,856 two-slice, electric toasters manufactured in 1925. This total output had a valuation of $1,885,780. The figures in the last column of the table below have been calculated from the total production of two-slice toasters in 1925. These figures, naturally, are somewhat low, as they disregard those commercial types of toasters which brown more than two slices. Seven of the major components of the electric toaster shown above are constructed wholly of steel, and in four other parts steel plays a most important role. Mica is employed in three of the latter four parts, and fibre in the remaining one. The handles of the toasters are made of molded insulation, while the bread holder handles are of hard rubber and brass. The cord is the usual type and the element is resistance wire.*

Part No.	Description	Material	Annual Production
1	Handles	Molded insulation	1,471,712
2	Element terminals	Steel, mica	1,471,712
3	Handle bolts	Steel	2,943,424
4	Base clamps	Steel	1,471,712
5	Bread holder handles	Hard rubber, brass	1,471,712
6	Element	Resistance wire	2,207,568 ft.
7	Attachment cord	Wire, asbestos, rubber	735,856
8	Bread holder	Steel	735,856
9	Base	Steel, fibre	735,856
10	Toaster body	Steel	735,856
11	Element supports	Steel, mica	2,943,424
12	Element rings	Steel, mica	2,207,568
13	Bread holder springs	Steel	1,471,712
14	Bread holder arm	Steel	1,471,712
15	Bread holder	Steel	735,856

Are you supplying your share of the raw materials and parts required for the annual production of

735,856

two-slice, electric toasters having a valuation of $1,885,780 in 1925?

Measuring Instruments

(*Continued from page* 45)

transformer, but not both with a wattmeter, the multiplier for the instrument indication is the ratio of the unit used, as 20:1, etc. When both current and potential transformers are used, however, the multiplier for the instrument indication is the product of the transformer ratios. For example: When a wattmeter with a full scale indication of 1.0 kw. is used with potential transformers having ratios 20:1 and voltage transformers having ratios of 20:1, the full load range of the wattmeter is then 1.0 x 20 x20 or 400 kw.

In the selection of portable instruments for general testing, the main essentials are rugged construction, accurate calibration and scales easy to read rather than low prices. Cases should be dust and moisture proof, and connections in the form of binding posts provided with non-removable tops so arranged that the binding posts cannot turn. Ammeters, voltmeters, volt-ammeters, and wattmeters should be well damped, but not sluggish.

Ammeters, voltmeters, volt-ammeters and wattmeters should be accurate within 1 per cent of full scale value at any point on the scale for commercial frequency up to 133 cycles. Frequency meters should be accurate to within ¾ to 1 per cent of normal frequency. For best accuracy, they should be operated with the voltage within 10 per cent plus or minus the normal value, and on currents not lower than 60 per cent of normal value.

Ammeters, voltmeters and volt-ammeters provided with an electro-magnet mechanism are readable from about 20 to 100 per cent of full scale value, and in selecting these instruments they should be selected so that normal reading is in the center of the scale.

Wattmeters, frequency meters and Powerfactor meters should be provided with movement and scales that are readable throughout their entire range. Ammeters, volmeters and wattmeters should be of such construction that they can also be used on direct current with good accuracy. All instruments should be provided with a zero adjuster, and the scale length should not be less than 5 in. long.

When ordering instruments the following information should be given for the different types:

Ammeters and voltmeters:—Give full range of instrument desired in the values to be measured, the value per division of scale to be used and transformer ratio where instruments are used with instrument transformers. When shunts are required with direct current ammeters the value of the maximum current should be given.

Wattmeters:—Give capacity of current element in amperes, the voltage range when desired for a single range, and separate ranges when 2 or 3 voltage ranges are desired. In connection with 2 and 3 voltage ranges, it is to be noted that only ranges with the same number of scale divisions can be conveniently combined and the scale ranges selected accurately from manufacturer's catalogue information for voltmeters. Wattmeters can be provided with double current capacity. It is a single capacity instrument when the current coils are connected in series and the current capacity is doubled by connecting the coils in parallel, but this information should be given when the instrument is selected. In addition to operating voltage of the main circuit, the instrument transformer primary and secondary voltages should be given, so that the wattmeter can be provided for the transformer ratio required. Values of shunts should be given, as for direct current ammeters. The normal ampere capacity of wattmeters is 5 amperes, with current transformers or shunts used for ampere capacities higher than this value.

Frequency meters:—Give cycles for which the Frequency meter should be calibrated and the voltage range. If the instrument must be used with external current or voltage transformers, the ratios of these transformers should be given and the primary and secondary current and voltage.

Powerfactor meters:—For Powerfactor meters, the capacities in amperes are usually 5 amps. The voltage range should be given, whether a single phase instrument is required, 3 phase, 3 wire or 2 phase, 3 wire or 2 phase, 4 wire.

Current Transformers:—Portable Current Transformers are usually designed for use with 5 ampere capacity instruments and for use on circuits up to 2500 volts, 25 to 133 cycles. The secondary winding is connected to the instrument by flexible leads. One form of portable Current Transformer combines a 25 ampere wound primary and an open type primary with a standard 5-ampere secondary winding connected to a pair of 6 ft. flexible leads. The primary opening is 1 x 2 in. This transformer can be used with either an ammeter or wattmeter, or both together, and with open primary the ratio with one conductor through the opening is 500-5 amperes, and with the conductor passed two times through the opening 250-5 amperes, four times through the opening, 125-5 amperes, and five times through the opening, 100-5 amperes. When using the wound primary the line leads are connected to binding posts providing a ratio of 25-5 amperes.

Multipliers:—A multiplier is used by connecting it in series with the voltage winding of the instrument, and enables the instrument to be used on a higher voltage. Multipliers must be provided for the instrument on which they are used and are not interchangeable for use on other instruments. They can be provided for use with a multiple range or capacity instrument and when so ordered, the multiplier is arranged for use with the highest range or capacity of the instrument. Multipliers can be obtained from low ratios to high ratios suitable for use with voltmeters having a scale range of from 3 to 750 volts. The particular range desired should be given when ordering a new instrument and when ordering a multiplier for an old instrument the serial number of the instrument should be furnished the manufacturer.

Selection of Motors

(*Continued from page* 49)

chanical brakes. A comparison of the two curves shows how much more complete the deceleration of the motor with the six to one speed ratio is, as compared to the high or running speed of the elevator, than in the case of the three to one speed ratio motor. This shows clearly why it is possible to use higher elevator speeds, if a motor is used with a higher speed ratio between the two windings. Smooth acceleration can be obtained to the low speed, the wear and strain on the mechanical brakes being no more than before.

The geared drive is accepted as the standard for A. C. elevator service. In the worm gear elevator, the motor is mounted direct on a steel shaft, at the end of which is cut a worm drive. This worm drive meshes with a large gear which in turn drives the cable drum or sheave. The motor runs at a high speed and the sheave more slowly, at ratios from 20 to 1, to 100 to 1. This results in a more economical installation, since the cost is from 30 to 50 per cent lower than the gearless traction equipment. The fact that there are many installations of the worm drive type operating satisfactorily on passenger elevators at speeds from 400 ft. to 550 ft. per minute indicates that this drive has proved very practical.

While we must still admit that the A. C. elevator installations will probably never acquire the velvety operation of the D. C. variable voltage D. C. motor drive, still due to the fact that the first cost of the A. C. elevator installation is much less than the variable voltage D. C. installation, it may safely be said that the A. C. installations will find a field for a long time to come.

"a big improvement over what we had been using . . . "

What do you want laminated bakelite to do? What electrical, mechanical and physical properties are required for better fabrication and performance in your particular case?

Every problem is a different one. Each specific use requires its own formula. Put it up to our Service Engineering Department to determine the formula which best meets your requirements right down the line—hardness, tensile strength, thickness, appearance, dielectric strength, machining qualities, weight, cost, etc.

Our files are replete with the data and formulae on thousands of problems in laminated bakelite. The solution to your difficulties is probably among them. Put it up to us to find out.

PHENOLITE

Reg. U.S. Pat. Off.

Laminated BAKELITE

SHEETS : RODS : TUBES : SPECIAL SHAPES

. . . it punches cold

One of America's largest radio manufacturers required a laminated bakelite which would punch cold without "cold flow" yet still retain its high dielectric strength and non-hydroscopic property. Our Service Engineering Department worked months on this problem—and solved it to the entire satisfaction of our customer. Perhaps we can do an equally valuable service for you in the laboratory "where known requirements meet known performance." Call us at any time.

NATIONAL VULCANIZED FIBRE COMPANY, WILMINGTON, DEL.

Offices in Principal Cities

Electrical Manufacturing News

A department containing news and descriptions of new materials, parts, devices and special tools for the manufacture and repair of electrical products

Discussions Outlined for Nema Mid-Winter Meeting

Industry trade practice conferences and tariff for electrical products will be the major topics for discussion at the mid-winter meeting of the National Electrical Manufacturers Association, to be held the week of Jan. 21 at the Hotel Commodore and Nema headquarters, 420 Lexington Ave., New York City.

The subject of industry trade practice conferences is one in which the entire association has evinced great interest. It is expected that many of the sections will take the necessary action requesting the Federal Trade Commission to call these conferences. In instances where sections have similar problems it has been suggested that they group their trade practices into one conference.

Tariff revision will be given careful consideration. The Tariff Committee, under the chairmanship of Thomas Allen, has been assisting the sections desirous of collecting and filing data on manufacturing costs to be presented before the preliminary hearings which the Ways and Means Committee of the House is conducting. As this issue of ELECTRICAL MANUFACTURING goes to press, the two hearings in which the electrical manufacturing industry is particularly interested are being held in Washington. They are Schedule 2, earthenware and glassware, and Schedule 3, metals and manufactures of metals.

The general meeting will be held at the Commodore on Wednesday afternoon. It is expected that the report of the J. Walter Thompson Company, analyzing the electrical market in the home and its plan for market development under the Electrical Industry Sales Conference will be presented at that time.

The board of governors will meet at Nema headquarters, Friday, Jan. 25. There will be a dinner party at the Commodore on Tuesday evening, Jan. 22.

Manufacturers Prepare Exhibits for Midwest Power Show

Exhibits, varied in scope and of such diversity as to contain genuine interest for the engineer and mechanic interested in tools, are being set in readiness by manufacturers whose products will occupy the 325 booths at the Fourth Midwestern Engineering and Power Exhibition, which will be held Feb. 12-16, in the Coliseum, Chicago. Visitors to the show are promised an opportunity to gain important knowledge and many ideas concerning the newer classes of equipment to be shown.

One of the outstanding features of the exhibition this year will be the coordinating, along practical lines, of exhibits of the same class. This will permit inspection with the least effort and with the greatest possible saving of time. The grouping of allied products will give a better picture and eliminate needless search. In addition to the machinery used in the generation, distribution and utilization of power, there will be exhibits devoted to heating, ventilating and refrigerating equipment.

A new innovation in power shows will be introduced during the same week, when meetings for engineers will be held at the Palmer House, Chicago. Diversified sessions have been outlined by the Conference, at which frank discussions of engineering problems will be held.

A. L. E. A. Announces Program for Virginia Beach Session

A business meeting of genuine value, plus a program of enjoyable entertainment, has been announced by the board of directors of the Artistic Lighting Equipment Association for the annual meeting which will be held at Virginia Beach, Norfolk, Va., Feb. 5-8. Interest evinced in the coming convention indicates that it will be the largest and most constructive session ever conducted by the association.

Among the discussions on the program for the business meeting are collections and credits, distribution costs and how they can be reduced, reducing costs by cost accounting methods, the value and opportunities in decorative lighting and the union situation. The annual election of officers will be a feature of the meeting.

Radio Improvements for 1929 Will Be Discussed by RMA

Following an epochal radio year, with record-breaking sales and usage of radio, plans for 1929 radio, including improved products and broadcasting, will be discussed Jan. 11-12 by the board of directors of the Radio Manufacturers Association. President H. H. Frost, who has called the meeting to be held at Briarcliff, N. Y., declares that many industry problems and the future of radio will be considered at the session.

No revolutionary changes in receiving set construction are in immediate prospect, according to Major Frost, but marked improvements, including those of design, loud speakers and other progressive developments are assured. Broadcasting, programs and transmission for the radio public will also be broadened and improved.

Serial Number Bill Submitted to State Legislatures

A model serial number bill which will protect the legitimate wholesaler and retailer in the handling of standard radio merchandise has been framed by the Federated Radio Trades Association, 32 W. Randolph St., Chicago, and is now being submitted to legislatures in various states. According to Harold J. Wrape, president of the association, the bill has met with the greatest approval of radio merchants throughout the United States.

The bill provides that any person, firm or corporation that destroys, removes, alters, covers or defaces the manufacturer's serial number, or any other manufacturer's trademark, distinguishing number or identification mark placed on any automobile, radio receiving set, vehicle, piano, musical instrument, washing machine or any other device, shall, upon conviction, be subject to a fine of not less than $200 or more than $500, or by imprisonment of not less than 30 days or more than 180 days, or both fine and imprisonment. A second conviction for the same offense calls for imprisonment of not less than one year or more than five years.

A. S. T. M. Chooses Atlantic City for June Convention

According to an announcement by the executive committee of the American Society for Testing Materials, the organization's annual convention will be held June 24-28 at Chalfonte-Haddon Hall, Atlantic City, N. J. The procedure of conducting two simultaneous sessions will again be followed.

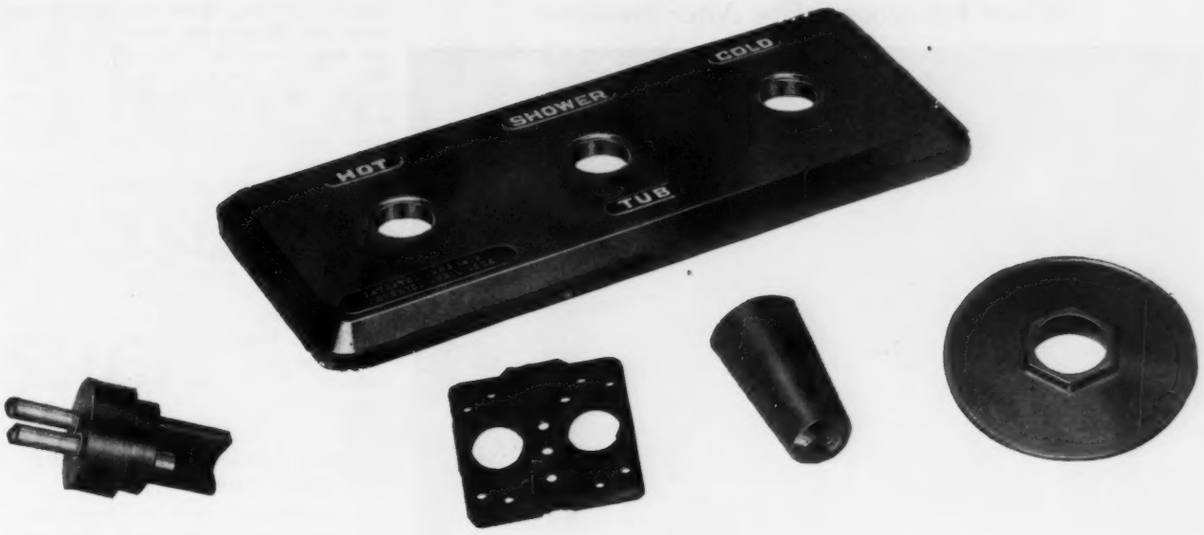
The society's officers are looking forward to a meeting which will in attendance and enthusiasm exceed those of former years. A complete business calendar, besides a program of diversion, is being completed by the executive committee and will be released in the near future.

Merger of R. C. A. and Victor Approved by Directors

The directors of the Radio Corporation of America and the Victor Talking Machine Company have approved the terms of merger between the two companies, whose securities have an aggregate market value of $625,540,000 on the New York Stock Exchange. Under the terms of the merger one share of new Radio common stock, one share of new Radio $5 preferred stock and $5 in cash will be distributed in exchange for each share of Victor common stock.

The combination of the two companies constitutes one of the most decisive in a series of important steps taken by the R. C. A. in its participation in the amusement industry. The R. C. A., its subsidiaries and affiliated companies now comprise a group of properties completely equipped to participate in every branch of popular entertainment. The Radio Corporation controls the National Broadcast-

(*Continued on page 70*)



"Unusual molding job," you say; but is it?

AS a rule, what appears to be a difficult molding to produce is one fully entitled to that distinction. However, as leading molders since almost the beginning of this work, International has in a sense long been inoculated against its difficulties. To us each new untamed job generally is just another of a family we know very well.

That is one reason why we so confidently invite your unusual jobs and promise flawless work. Another is the assurance given us by our steady, untroubled flow of production, in heavy volume, on difficult molding jobs for many different customers.

So bring on your problem. You can shift the whole of it to us--making your molds, producing metal inserts, assembling, everything. The job will come through on your schedule as you want it.

PRECISION MOLDERS OF BAKELITE AND SHELLAC COMPOSITION

INTERNATIONAL INSULATING CORPORATION

Division of The General Industries Co.

ESTABLISHED 1875 ELYRIA, OHIO

Large scale production working at full capacity, with complete, best modern equipment, are at your disposal. International estimators will serve you without obligation.

Where Efficiency Struts After Sundown

THOUSANDS of construction centers throughout the world have become veritable lands of the midnight sun as a result of the adoption of floodlighting for night work. Darkness was no impediment in the erection of the Louisville, Ky., power house, shown above, which ranks seventh in size in the United States

ing Company, R. C. A. Photophone, Inc., and is allied with the Radio-Keith-Orpheum Corporation. In its present merger, Victor's contact with many musical artists will become available for sound pictures and broadcasting.

The unification of R. C. A. and Victor includes the holdings of the Victor Company in subsidiary and associated companies throughout the world. It is expected that Edward E. Shumaker, president of Victor, will become an officer of the Radio Corporation in charge of the Victor division and that his staff will be retained largely as now constituted.

Lighting Equipment Production Shows Gradual Rise

According to the Department of Commerce data collected at the annual inquiry on the manufacture of lighting equipment, the total value of such equipment produced in 1927 was $251,449,061. The corresponding values for 1926 and 1925 were $240,373,608 and $217,793,077, respectively. The statistics presented are based on material collected from manufacturers of electric, gas and other lighting equipment, and also from establishments which assemble such equipment from purchased parts.

During 1927 incandescent electric bulbs headed the list in the total value of production. Fifty-eight establishments reported a total of $81,524,060. Residential lighting fixtures stand second with a value of $58,862,528. Under this classification the largest single type produced was ceiling or chandelier, total value $16,279,870.

Motor vehicle lamps are third in value of production with a total of $20,053,298. Commercial lighting fixtures came fourth, total value $18,441,088. Public building, bank and office building type fixtures constitute the largest group under this head. Shades for lighting fixtures of all types stand fifth, total value $14,628,534.

With the exception of residential lighting fixtures, shades and reflectors, all of which represented slight losses, the year 1927 witnessed a gain in every class of lighting equipment. There were reports from 915 establishments in 1927, 880 in 1926 and 797 in 1925.

Tariff Hearings Draw Interest of Electrical Manufacturers

Under the guidance of the Tariff Committee of the National Electrical Manufacturers Association, the electrical manufacturing industry has evidenced a quick response to the notice of general tariff hearings which will be conducted by the Committee on Ways and Means of the House of Representatives. The preliminary hearings, arranged under a system of product schedules, will be held from Jan. 7 to Feb. 25, 1929.

A number of the individual sections of Nema have already filed figures with the Tariff Committee showing the percentage of cost represented by labor, material and overhead.

Time-O-Stat Controls Company Acquires Four Concerns

According to a statement by Julius K. Luthe, formerly president of the Time-O-Stat Corporation, Milwaukee, Wis., plans have been completed for the Time-O-Stat Controls Company, incorporated in Maryland, to acquire the business and assets of the Absolute Con-Tac-Tor Corporation, Elkhart, Ind., the Leachwood Company, Janesville, Wis., the Cramblet Engineering Corporation and the Time-O-Stat Corporation, Milwaukee, Wis.

The Time-O-Stat Controls Company will manufacture a varied line of automatic controls including regulators for boilers and furnaces for both domestic and industrial uses; automatic refrigerator, blower and stoker controls, mercury electric switches, metal bellows, thermostats, sign flashers and clock controls for gas and electricity. Through the acquisition of the lines of the several companies, and also their facilities and patents, the new firm will be enabled to effect improvements in its general line of products.

A plant is being constructed at Elkhart, Ind., and upon completion the merged companies will lose their separate identities and house the new structure. The principal officers of the Time-O-Stat Controls Company are Julius K. Luthe, president; Paul K. Cramblet, formerly president of the Cramblet Engineering Corporation, and E. J. Leach, formerly general manager of the Leachwood Company, vice-presidents.

Credit Association Will Hold Semi-Annual Meeting

A number of vital problems have been listed for discussion at the semi-annual meeting of the board of directors of the National Electrical Credit Association which will be held Jan. 29, at Philadelphia.

All members interested in changes of by-laws and operative resolutions, expansion and improvement in the service, the altering of the association's name to the National Electrical Radio and Credit Association, and the question regarding the arranging of the national monthly under a geographical state plan, should make their views known to the local secretary or executive board, so that members on the national board may present their members' wishes.

Sperry Elected President of Mechanical Engineers

Elmer A. Sperry, whose career in invention covers almost half a century and who has taken out more than 400 patents, was elected president of the American Society of Mechanical Engineers in a national mail ballot among 20,000 members. He was installed in office at the opening session of the society's annual meeting, held in New York City the week of Dec. 3. Mr. Sperry's major achievements include the development of powerful arc lights, invention of the gyrocompass and application of the gyroscope to the stabilization of ships and airplanes.

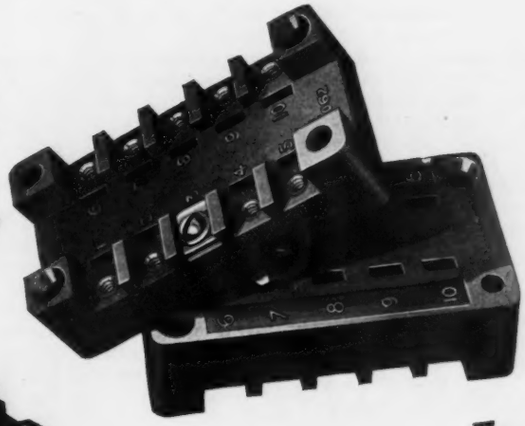
Elmer A. Sperry

Reduction in Freight Rates Urged on Radio Shipments

New demands and information upon which the radio industry is urging reduced and equitable freight rates have just been presented by the Traffic Committee of the Radio Manufacturers Association to the Joint Classification Committee of the principal railroads. A united front in their

(*Continued on page* 72)

There's a reason for such moulding success



IT is reasonable to suppose that a moulding organization passing its fortieth anniversary of service with the largest and newest equipped moulding plants in the world, would have a reason for such success.

SCRANTON has a reason, and a good one. Its policy of producing the highest grade of accuracy, uniformity and finish in SCRANTON moulding at the lowest price consistent with such quality has inspired confidence in all industries among the most exacting customers.

It is due you to call your attention to SCRANTON'S undisputed leadership, so that you may utilize the best means available to make your use of plastics successful. SCRANTON engineers furnish active co-operation, and will advise gladly on any moulding problem you have.

SCRANTON MOULDS retained by us are always repaired, insured and renewed if necessary, without additional expense to the customer, unless otherwise agreed.

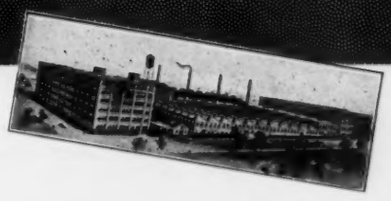
THE SCRANTON BUTTON CO.

Plants at SCRANTON, PA., *and* AUBURN, N. Y.

NEW YORK, N. Y.—50 Union Square
CLEVELAND, O.—4900 Euclid Bldg.
SCRANTON, PA.—419 Cherry St.
CHICAGO, ILL.—645 Washington Boul.
DETROIT, MICH.—114 E. Lawn Ave.
AUBURN, N. Y.—40 Washington St.

SCRANTON

The world's largest and newest-equipped moulding plants



Main offices and Plant, Scranton, Pa.

Auburn Plant, Auburn, New York

demands for railroad rate reductions on radio products is being presented by the radio manufacturing industry to secure fair and reasonable railroad rates in the interest of radio dealers and jobbers and the public, as well as of manufacturers.

The detailed demands, upon which unanimous agreement was reached, were prepared at a meeting held by the RMA Traffic Committee. Captain William Sparks of Jackson, Mich., chairman of the committee, presided, and the traffic managers of fifteen of the principal radio manufacturing companies, including manufacturers of radio and talking machine combinations, agreed upon the freight rate reductions. Bond P. Geddes, executive vice-president of the RMA, and W. J. M. Lahl of Chicago, manager of the RMA traffic bureau, were also in attendance.

Electrical Equipment Exports Show Considerable Gain

Exports of electrical equipment from the United States during October, 1928, amounted to $10,311,643, a gain of $2,336,190 as compared with the corresponding month of 1927. It is the largest monthly total since the post-war period, with the exception of December, 1927. Shipments of electrical apparatus for the ten months ending Oct. 31, 1928, amounted to $89,622,824, an increase of $7,394,480, compared with the same period of 1927.

The outstanding gain for October was in radio equipment, while refrigerators up to one-ton capacity, bare copper wire and lighting fixtures, both interior and exterior, showed large increases.

Sales of American Batteries Increasing in Germany

According to a recent report of the Department of Commerce, the demand in Germany for American storage batteries is steadily increasing, despite sharp competition from German manufacturers. This demand exists in both the automotive and the radio fields, the call for the latter being in the small battery line.

Radio receiving sets which operate directly from light sockets have appeared on the market, but due to their high cost they have not yet been generally adopted by the German public. The price for American storage batteries is about 20 per cent higher than that of the German.

V. R. Despard Joins Chicago Mica as Secretary-Treasurer

Victor R. Despard, for the past nine years vice-president of the McGill Manufacturing Company, Valparaiso, Ind., has purchased the holdings of John F. Griffin, retiring secretary-treasurer of the Chicago Mica Company of Valparaiso. At a special meeting of the board of directors Mr. Despard was elected to the position formerly held by Mr. Griffin.

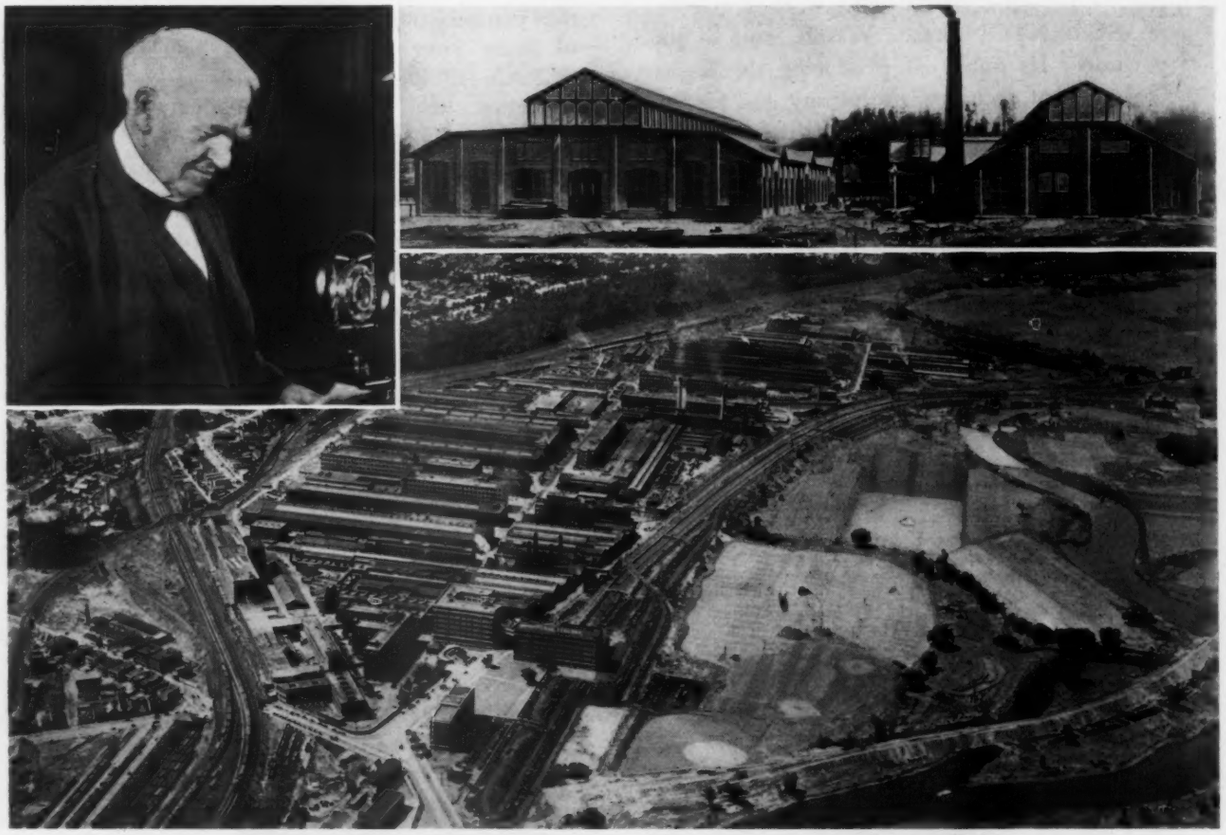
Mr. Despard was a member of the sales force and manager of the Chicago office of Pass & Seymour for seven years before he resigned in order to organize the concern of Despard & Gordon. The manufacture of "Levolier" wiring devices, a new idea in the electrical field, met with wide acceptance by the trade. The new business grew to such proportions that an expansion policy was adopted and the firm entered a consolidation with the McGill Manufacturing Company.

Arrow Electric Company Merges with Hart & Hegeman

Announcement has been made that the Arrow Electric Company, Hartford, Conn., and the Hart & Hegeman Manufacturing Company, of the same city, have merged and become one corporation under the name of the Arrow-Hart & Hegeman Electric Company. The new concern will have two divisions, the Arrow Electric Division and the Hart & Hegeman Division, which will operate independently through their own distributing channels.

(*Continued on page* 74)

Time Finds Changes in the Quarters of Edison's Machine Business



DECEMBER 15, 1928, *marked the forty-second anniversary of the founding of the General Electric Company at Schenectady, N. Y. The occasion was celebrated by the unveiling of a tablet on one of the two original structures. The works shown above, upper right, were established by Thomas A. Edison in* 1886. *The airplane view pictures the works, covering* 350 *acres, as they are now. Mr. Edison appears at the upper left, addressing the vast gathering which attended the exercises*

Another new . . . . . G-E product . . . . . .

TEXTOLITE LAMINATED

TEXTOLITE laminated is composed of thin, non-metallic sheets impregnated with synthetic resin and compressed in powerful presses.

Millions of pounds of plate, rod, and tube have been manufactured by General Electric for its own use during the last five years.

This huge production demanded extensive facilities for manufacture, and resulted in unsurpassed technical experience.

General Electric offers these advantages to every user of high-quality laminated materials; and it further offers the unexcelled resources of its famed research laboratories and its world-wide service.

The same high quality which distinguishes G-E electric equipment is built into every piece of Textolite laminated.

Complete stocks of standard rod, tube, and plate are always on hand; and special sizes and shapes can be supplied on short notice.

Inquire at the nearest G-E office for complete information.

885-14

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Edison Medal Committee Votes Award to Dr. F. B. Jewett

The Edison Medal, which is awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts" by a committee consisting of 24 members of the American Institute of Electrical Engineers, has been awarded to Dr. Frank B. Jewett for his contributions to the art of electrical communication. The medal will be presented to Dr. Jewett on Jan. 30 at the winter convention of the institute in New York City.

Frank B. Jewett

Dr. Jewett, vice-president of the American Telephone and Telegraph Company and president of Bell Telephone Laboratories, Inc., was born at Pasadena, Cal., in 1879. He received his technical education in his native State and then took up graduate work at the University of Chicago. He has been identified with the American Telephone and Telegraph Company since 1904. In 1916 he became chief engineer in charge of all research work and six years later was elected vice-president.

Recipients of the medal in former years have been: Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell, Nikola Tesla, John J. Carty, Benjamin G. Lamme, W. L. R. Emmet, Michael I. Pupin, C. C. Chesney, Robert A. Milliken, John W. Lieb, John W. Howell, Harris J. Ryan and William D. Coolidge.

New Corporation Will Comprise Six Brass Concerns

Directors of the Rome Brass & Copper Company have approved a plan to merge with five other companies to form the Republic Brass Corporation, according to a recent announcement. The merger plans, it is understood, are being sponsored by the American Smelting and Refining Company, of which the new concern will be a close affiliate.

The companies expected to be taken in by the Republic Brass Corporation include the Rome Brass and Copper Company, Baltimore Sheet Mill Company, a division of the General Cable Corporation, Higgins Brass Manufacturing Corporation, Dallas Brass and Copper Company, Taunton-New Bedford Company, and Michigan Brass and Copper Company. The latter, a subsidiary of American Smelting, has already been sold to the Republic Brass Corporation.

Industrial Controller Merger with Square D Pending

The Square D Company, Detroit, Mich., has practically completed negotiations for the purchase of the Industrial Controller Company, Milwaukee, Wis., manufacturer of pressure switches and electrical controls. Directors of both companies have approved the transaction, which is about to be submitted to stockholders of the two companies.

Panelboards, a recent addition to the Square D line of electrical devices, were shipped to the trade for the first time in November last. It is expected that the sales of the new product will add 25 per cent to the company's total volume of business soon after the completion of the new plant, which is now under construction in Detroit.

Fuller & Johnson Co. Purchased by Second Ward Securities

Control of the Fuller & Johnson Manufacturing Company, Madison, Wis., has been purchased by the Second Ward Securities Company and the Quarles Company of Milwaukee, Wis., according to a recent announcement.

The Fuller & Johnson Company has been reorganized and additional capital has been supplied, but the policy of the company remains unchanged. The directors of the company include C. L. McMullen, president; W. H. Spohn and T. G. Montague of Madison; H. L. Horning and S. A. Perkins of the Waukesha Motor Company, Waukesha, Wis.; Willitz Pollack, vice-president of the Second Ward Securities Company, and J. B. Angle of the Quarles Company.

Brevities

Holtzer-Cabot Electric Company, Boston, Mass., has been purchased by the Gamewell Company, Newton Upper Falls, Mass., manufacturer of electric signal systems.

R. D. Nuttall Company, Pittsburgh, Pa., manufacturer of gears, has announced the appointment of H. A. Houston, formerly connected with the Westinghouse Electric & Manufacturing Company, of which the Nuttall Company is a subsidiary, as works manager.

Manhattan Electrical Supply Corporation, New York City, has purchased the United States Manganese Corporation, according to a recent announcement. The new acquisition includes the rights to about 8,400 acres of mining land in Augusta County, Va.

Copeland Products, Inc., announces that there will be no changes in its policies or personnel following the resignation of George W. Mason as president.

Synthane Corporation is completing an addition to its plant at Oaks, near Philadelphia, Pa. The corporation expects to begin production on laminated bakelite products in the early spring.

Botfield Refractories Company, Philadelphia, Pa., manufacturer of Adamant fire brick cement and super-refractory mixtures has appointed McCarthy-Jones & Allen Company, 111 First Ave., Nashville, Tenn., as distributor of all its products.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has moved its Atlanta office to new quarters at 150 Peters St., S.W., Atlanta. In addition to sales and engineering service on motor control and wiring apparatus, the new location provides warehouse facilities where stock will be kept for shipment to customers in that territory.

Light Metal Stamping Company, 310 W. 13th St., West New York, N. J., manufacturer of fixture fittings, is the new name for the Triumph Manufacturing Company.

Miami Copper Company has placed an order for new switching apparatus, calling for 13 electrically operated, type B-32 oil circuit breakers, with the Westinghouse Electric & Manufacturing Company.

Manufacturers' Catalogs

Westinghouse Electric & Manufacturing Company, E. Pittsburgh, Pa. Publication No. 1717-C, engineering achievements of the Westinghouse Company for 1928.

Electric Machinery Manufacturing Company, Minneapolis, Minn. Forty-eight page book on power factor correction with Capacitors.

Revolvator Company, 336 Garfield Ave., Jersey City, N. J. Bulletins 83 C and D, floor locks and hoists.

Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Catalog, distribution transformers in single-phase and three-phase pole-type and subway-type, in ratings up to and including 500 kv-a.

Falk Corporation, Milwaukee, Wis. Bulletin No. 190, herringbone speed reducers.

Personals

R. L. Matthews has joined the sales force of Wagner Electric Corporation, St. Louis, Mo. Since leaving Purdue University, where he studied electrical engineering, he has been connected with the Michigan Bell Telephone Company, the Armstrong Cork & Insulation Company and the National Electric Products Corporation. Mr. Matthews will be connected with the Wagner Chicago office.

Frank A. Ketcham, formerly executive vice-president, has been chosen president of the Graybar Electric Company, New York City. He has been

Hotel Range and Bakelite Molded Switch Handles used on it. Made by Edison Elec. Appliance Co., Chicago, Ill.

One month's production costs saved through using *Bakelite Molded*

A REDUCTION of 8⅓% in the cost of a part is equivalent to saving the entire production cost for a whole month out of each year. Such a saving actually represents a "bonus" of a month's supply of finished parts.

The use of Bakelite Molded has enabled the Edison Electric Appliance Company to make this saving of 8⅓% on the switch handles for electric ranges. Bakelite Molded replaced aluminum handles at a lower cost.

In the molding process, the threaded bronze bushing is firmly embedded and made an integral part of this switch handle without an extra operation. Each handle leaves the mold finished with a lustrous surface that requires no subsequent machining or polishing.

Improved design marks the new switch handle of Bakelite Molded and the pleasing maroon color adds to the attractive appearance of these ranges. Even more important is the protection afforded by the high insulation value of Bakelite Molded. Unlike metal, it provides "never-hot" handles for this kitchen equipment.

Bakelite Engineering Service

Intimate knowledge of thousands of varied applications of Bakelite Materials combined with eighteen years' experience in the development of phenol resinoids for electrical uses provides a valuable background for the cooperation offered by our engineers and research laboratories. We invite you to take advantage of this production-saving service. Write today for a copy of Booklet 52M, "Bakelite Molded."

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office, 635 West 22nd Street

BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ont.

BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation Under the capital "B" is the numerical sign for infinity, or unlimited quantity It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

associated with Graybar and the Western Electric Company since 1900.

John Livor, for 21 years associated with the General Electric Supply Corporation as manager of the fixture department, secretary and sales manager, has announced his retirement from the company. He has established himself as a sales specialist and is ready to serve manufacturers of electrical appliances and equipment who desire to enter the electrical field or to increase their business in New England. Mr. Livor's offices are located at 1105 Statler Building, Boston, Mass.

A. R. Erskine, president of the Studebaker company, has been elected to the board of directors of the Electric Household Utilities Corporation.

O. S. Sleeper, an engineer well known in the chemical plant and equipment field, has become associated with the F. J. Stokes Machine Company, Philadelphia. He will be located in the company's new office building in Philadelphia.

Obituary

Edward R. Welles, president of the Public Industrials Corporation, New York City, and consulting engineer to the J. G. White Engineering Corporation, died at his home in Brooklyn, N. Y., Dec. 15, after a brief illness. He was 50 years of age.

Lewis H. Latimer, an electrical engineer known throughout the United States and a member of the Edison Pioneers, died at his home in Flushing, N. Y., on Dec. 11, in his 80th year. He drew for Alexander Graham Bell the original plans of the telephone. He was at one time associated with the General Electric Company.

Edward Preston Clifford, vice-president of the Bell Telephone Laboratories, died of bronchial pneumonia at his home in New York on Dec. 16, in his 53rd year. He had been commercial manager of the Bell Telephone Laboratories since 1925, during which period important experiments were carried on in television and the transmission of pictures by wire.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Ave., New York City.

"L. R. Co." Receptacles.
"Splendida" Electric Iron.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Blaisdell" Automatic Electric Cigar Lighter.
"Columbus-Universal" Electric Vacuum Cleaner and Floor Polisher.

Manufacturers of electric-driven lampshade lacing machines.

"Vesodore" Cigar Lighter.

Address of Buckeye Instrument Co. (manufacturers of instruments) asked for in our November issue. Last known address is 4827 Lexington Ave., Cleveland, Ohio.

Coming Conventions

American Engineering Council.—Annual meeting at Washington, D. C., Jan. 14-15.

American Institute of Electrical Engineers. — Annual winter convention at New York City, Jan. 28-Feb. 1, 1929.

American Washing Machine Manufacturers Association.—Annual meeting at Hotel Drake, Chicago, Ill., Jan. 18, 1929.

Artistic Lighting Equipment Association. — Annual meeting at Cavalier Hotel, Virginia Beach, Va., Feb. 5-7, 1929.

Federated Radio Trades Association. —Meeting at Buffalo, N. Y., Feb. 18-20.

Midwest Power Conference and Exhibition.—Fourth show at the Coliseum, Chicago, Feb. 12-16, 1929.

National Electric Light Association. —Annual convention and exhibition at the Municipal Auditorium, Atlantic City, N. J., June 3-7.

National Electrical Manufacturers Association, Supply Division.—Meeting at Hotel Commodore, New York City, and at Nema headquarters, 420 Lexington Ave., New York City, week of Jan. 21.

National Electrical Manufacturers Association. — Annual meeting at Hot Springs, Va., week of May 20.

National Electrical Wholesalers Association.—Meeting of executive committee at the Mayflower, Washington, D. C., Feb. 26-27. Semi-annual convention at the Homestead, Hot Springs, Va., May 27-31.

The Society for Electrical Development.—Meeting of the board of directors at New York City, March 8.

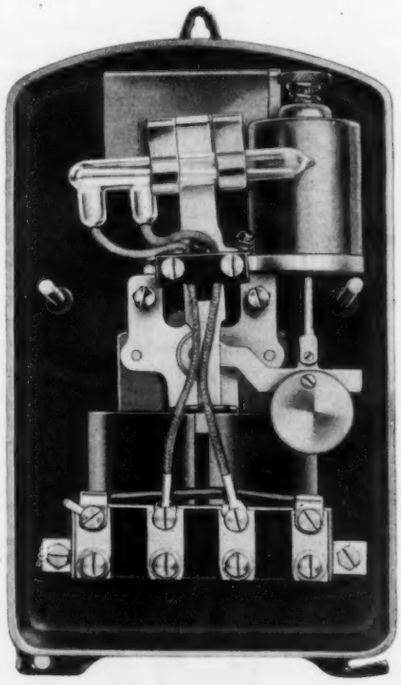
New Goods for Your Inspection

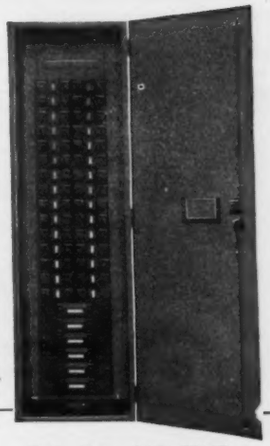
Acid Core

American Solder & Flux Co., 2910 N. 16th Street, Philadelphia, has placed on the market Acid Core, a complete solder which is said to require no flux. It is stated that Acid Core will solder all metals, with the exception of aluminum. The only action needed is to heat the joint with a soldering iron or torch and apply the Acid Core. Acid Core solder is packed in one, five, ten and twenty lb. spools; 100 lbs. to the case for one, five and ten lb. spools and 120 lbs. to the case for twenty lb. spools. Rosin core, another product of the American Solder & Flux Co., is believed to be especially adaptable to use on delicate work such as: radio, telephone and instrument equipment.

Sign Flasher

General Kontrolar Co., Inc., 200 E. First Street, Dayton, O., announces the Kontrolar sign flasher, type MP for electric signs, window displays, traffic signals, light beacons, call systems and master controls. This flasher embodies a motor, with weight causing oscillation, a supporting bracket, a quick make and break snap-action in combination with a heavy duty, mercury contact tube, and an adjustable air control. Perfect flashing effects are secured by a combination of high capacity tubes, quick make and break snap-action and precision pneumatic control. Upon closing the line circuit the motor-relay is energized, causing a powerful rotation of the armature mounted between its poles with its corresponding lever, carrying the weight and actuating the air control mechanism. The speed of rotation of the armature is governed by the valve opening, permitting more or less air to escape in a given period of time, depending on the valve setting. When the predetermined time element has elapsed this motion is transferred with a quick make and break snap-action to the tube lever carrying the contact tube, or tubes, respectively.





Bull Dog SAFtoFUSE Power Feeder Panel Complete.

One of the fifteen SAFtoFUSE units in the above panel showing the great intricacy of the mould.

Kurz-Kasch thrives on such intricate moulding jobs as this one

THIS piece, moulded in Bakelite, was made for the Bull Dog Electric Products Company, Detroit, Michigan, and is a good example of how Kurz-Kasch tackles a moulding problem involving intricate design, exactness and uniformity of finish.

There are few industries that Kurz-Kasch has not served with satisfaction. There are many representative manufacturers in the electrical industry who realize the material economy in putting their moulding jobs up to Kurz-Kasch—they have forgotten about such details as "how can it be done?"

Kurz-Kasch craftsmen are masters in moulding Bakelite—the size of the piece or the quantity doesn't bother them.

Whatever your problem may be you can safely entrust it to Kurz-Kasch to solve *finally*.

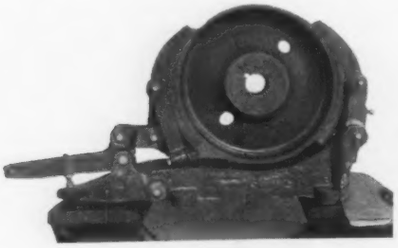
The KURZ-KASCH Co.

Dayton, Ohio, U.S.A.

PLASTIC MOULDING HEADQUARTERS

Crane Brake

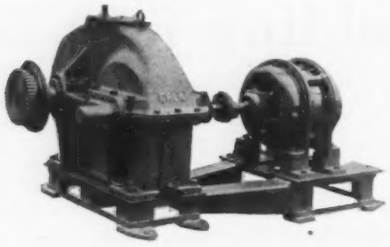
Electric Controller & Mfg. Co., 2700 East Ohio St., Cleveland, has placed on the market the Type WB mechanically-



operated brake for use on the bridge drives of electric traveling cranes, lift bridges and electric hoists and other applications requiring foot-operated or hand-lever operated brakes. This brake is a modification of the electrically-operated, Type WB brake, and all wearing parts of the two brakes are interchangeable. The tendency toward the use of anti-friction bearings on cranes has increased the amount of work to be performed by the brake. The crane will drift along with the power shut off, and the brake must stop it unaided by bearing friction. For this reason the brakes are equipped with unusually thick molded asbestos linings that are designed to require renewing only after a long period of operation.

Speed Reducers

Falk Corp., foot of 30th Street, Milwaukee, Wis., has added several new sizes of speed reducers to their equipment, in-



cluding four single reduction units, three double reduction and three triple reduction units, plus nine sizes of single reduction units, with vertical centers, making a total of 48 different sizes. A complete line of welded steel motor beds has been added, which means that each unit can be had with a welded steel or cast iron motor bed. Such motor beds contribute greater strength to the units. The specifications of the low speed shafts have been changed from 50 to 60 per cent carbon steel to alloy steel, which makes possible the heavy shock loads and sprocket pulls to which speed reducers are sometimes subjected. Another improvement is the new method of forging pinions. They are not machined from ordinary bar stock, but are made of heat-treated chrome vanadium steel by the upset forging process. The smaller gears are made of drop forgings, while the larger ones are made of "Telastic" steel. Through bolts, made of heat-treated steel, are used throughout the entire line of speed reducers. Airplane type sleeve bearings remain unchanged. A new lubrication plate, attached to the base of the gear, gives instructions as to the proper grade of oil to be used under every operating temperature and condition. All reducer parts, including gears for the standard ratios, are carried in stock.

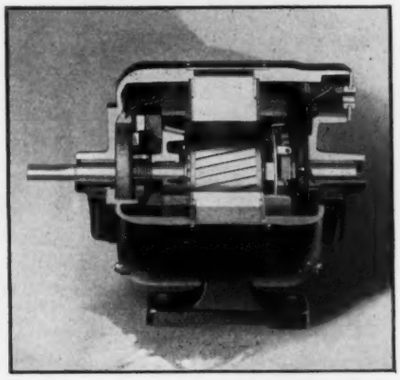
Preforming Press

F. J. Stokes Machine Co., 5826 Tabor Rd., Philadelphia, has placed on the market a preform press turning out a "ball"

preform, which can be fed into the molding press by gravity. It is stated that this press makes the most perfect ball ever made on a tablet machine, and that the preform, unlike the output of presses designed for similar purposes in the past, rolls straight into the feeding mechanism, thereby saving an enormous amount of time and labor. The normal speed of the press is 250 to 500 preforms per minute, depending upon the size and model. Production of preforms by this method of the proper size, weight and density, and in a shape to feed by gravity, has been adopted by several of the larger manufacturers of molded parts and can be used advantageously, it is stated, by any molder for quantity output.

Induction Motor

Sunlight Electrical Mfg. Co., Warren, Ohio, announces the Sunlight Magnetic induction motor, a split-phase motor which is designed to have all the desirable features of a repulsion-induction motor at a price comparable with that of the ordinary split-phase motor. Its performance is designed to come well within the requirements of the fractional horsepower committee of the N. E. L. A. When starting, the motor runs free on its shaft. After about three-quarter speed has been obtained, the clutch is automatically thrown in and power is applied to the shaft. If the motor becomes overloaded, its decreased speed causes the clutch to disengage and engage again repeatedly. When stalling is imminent, the clutch is disengaged entirely and dangerous wear due



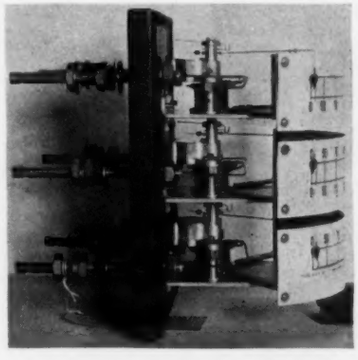
to overloading and overheating are eliminated. The fact that the motor does not pick up its load until it reaches three-quarter normal speed is designed to keep the inrush of current at starting low.

Manganese Steels

Carnegie Steel Co., Carnegie Building, Pittsburgh, has placed on the market a grade of screw stock or threading steel containing manganese of 1 per cent and over, and sulphur of one-tenth of 1 per cent and over, and is designed to meet the demands of high speed machining and strength, and to give a tough core after case hardening. Another grade for forging purposes responds to heat treatment in a manner similar to the more expensive steels, such as 3½ per cent nickel and low nickel chrome steels.

Polyphase Ammeter

Roller-Smith Co., 233 Broadway, New York, announces type HEA-3 polyphase ammeter, whose specific application is for



three phase, alternating current circuits. The HEA-3 ammeter is distinguished by its 7⅛ in. scale. It is most useful when close readings are desired. This instrument consists of three horizontal, edgewise mechanisms, mounted one above the other in a single case and utilizing a single window. Accurate comparisons of the current can be made in three different phases. The relatively small switchboard space, as compared with the area occupied by three standing, full-size, horizontal, edgewise instruments is another feature of this ammeter.

ENGINEERING SERVICE *in* BAKELITE MOULDING

Now Available to Manufacturers in the Middle West

If you are a mid-western Electrical Manufacturer, we are equipped to give you service in Bakelite Moulding. We have a thoroughly experienced Bakelite Engineer ready for personal consulation with you at all times.

A Modern Plant at Chicago

Geared for high production that insures speedy delivery.

Close enough to give you personal service. Write or telephone. Our engineer will call. No obligation on you for this request.

Schneider Brothers
INCORPORATED
304-314 NORTH SHELDON ST.
CHICAGO

For your active file- *these two compact catalogs*

Covering both Campbell Fibre and CAMPBELLITE (for various specific uses), their characteristics and superior production methods. Busy electrical executives who need boiled-down facts on insulation welcome these catalogs. We have many grades to meet all production needs; let us help you select the right one.

Samples as requested

CAMPBELL FIBRE CO., *Heather Ave., Stanton, Del.*

Moulding in BAKELITE

The reason our BAKELITE moulding service is so unusually accurate, economical and speedy is because we are mould-makers of long experience. No lost time, no half-finished castings. Let us quote you on your blueprints or specifications.

Kuhn & Jacob Machine & Tool Co.
502 Prospect Ave.
Trenton, N. J.

We make our own moulds

CETEC ON THE WHIPPET

ANOTHER example of CETEC's wide and varied usefulness is this Whippet radiator cap. Low cost was not the only reason for selecting CETEC. High heat-resisting quality, ability to take the threaded metal insert, hardness, denseness, durability and glossy finish—were still more important.

CETEC is available in black, brown, and beautiful mottled effects. Send us samples, blueprints, or models of any molded parts. It is more than likely we can save you money.

MOLDED "CETEC" PRODUCTS

CONNECTICUT
MOLDED PRODUCTS CORPORATION
MERIDEN, CONN.

Give us full information about CETEC and its use in the following parts:

_____

_____

Name _____

Address _____

City _____ State _____

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of ELECTRICAL MANUFACTURING is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of ELECTRICAL RECORD as heretofore. This Classified Index has been an exclusive ELECTRICAL RECORD feature for over thirty-six years.

ALLOY LIGHT METAL
Bohn Aluminum & Brass Corp., 2572 E. Grand Blvd., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa, Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.

AMMETERS. See Instruments.

ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
News. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.

ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.

ARMORING MACHINES. See Wire Manufacturing Machines.

ARMS, FLEXIBLE. See Tubing Flexible Metallic.

ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Asbestos, Shingle, Slate & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp. (Elec'l Dept.) New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Deceleco, Inc., Wayne, Mich.
Federal Insulating Corp., Yonkers, N. Y.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Deceleco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Twentieth Century. See Sundstrand Machine Tool Co.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.

BEARINGS
Aladdin Mfg. Co., Sales Div. No. 802, Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.
Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hemill Products, Inc., 103 Mott, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marbleart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.

BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 317 E. 29th, Chicago, Ill.
Bantam Ball Bearing Co., South Bend, Ind.
Braun Bearings Co., Primos, Pa.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 325 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Selb Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Morsine Products Co.
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Morsine Products Co., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.

BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.

BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.
BOX & CABINET BUSHINGS. See Bushings, Box & Cabinet.

BOX BOARD
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago

BOXES, Fibre
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago

BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., 417 N. Eighth, Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 325 Decatur, Sandusky, Ohio.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago
National Folding Box Co., New Haven, Conn. (Cartons.)
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.

BRACKETS, Instrument
For Suspending Meters to Station Switchboard.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BRAIDING MACHINES. See Wire Manufacturing Machines.

BRASS TUBING. See Tubing, Brass and Copper.

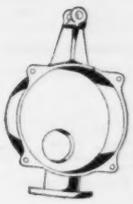
BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
American Nickeloid Co., Peru, Ind.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1312 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.). Baltimore, Md.
Bohn Aluminum & Brass Corp., 2512 E. Grand Blvd., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Dallas Brass & Copper Co., 812 Orleans, Chicago, Ill.
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)

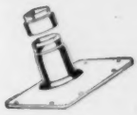
BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

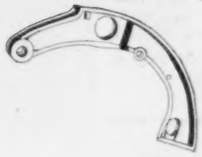
BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)
Brush Holders ..... See B
Carbon, Graphite, Metal Graphite ..... See C
Flexible Leads and Pig Tails ..... See L
Sheet Metal ..... See S
Wire Gauze ..... See W

Automotive Mfg. Co., Kansas City, Mo. ..... H
B. B. B. See Becker Bros. Elec'l Corp.
Baylis Co., Bloomfield, N. J. ..... H
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill. ..... C W S H L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y. C
Boxill-Bruel Carbon Co., Columbia Park, O. C ..... H
Burrows & Co., 1135 W. Van Buren, Chicago, Ill. C
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. C
Carbon Engrg. Co., Slinger, Wis. ..... O L
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O. C
Carbon & Graphite Corp., 227 West Broadway, New York, N. Y. C

THIS NEW-DAY COMPETITION DEMANDS *MODERN* METHODS







KEENER competition; closer margins; costlier labor; high transportation rates; *all* are combining to challenge your ingenuity to produce a *better* product for less money.

Alumac Die Castings of Alcoa Aluminum take increasingly important place in this new-day industrial contest.

They offer you equal or greater strength with *less than half* the weight of other castings; they offer you extremely close tolerances *in production* (usually plus or minus .0015 inch per linear inch); they eliminate much machining and finishing and thus speed up your production schedule. Their lightness reduces handling and shipping costs.

Very definitely, it will pay you to present your production problems to one of our Die Casting Specialists who will be glad to consult with you on request and without obligation. Write us at once.

ALUMINUM COMPANY OF AMERICA
2471 Oliver Building Pittsburgh, Pa.

ALUMINUM

ALUMAC
TRADE MARK

DIE CASTINGS

For Strength, Lightness, Economy

Die Castings

Aluminum, Tin, Lead and White Brass, Special Machines, Dies, Tools, Jigs and Stampings

Advance Tool & Die Casting Co.
1654-60 Holton St., Milwaukee, Wis.
Edgewood 284

BRUSHES, Commutator—Continued
Carenco. See Carbon Engineering Co.
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y. ..... C W S .. L
Columbia Machine Wks., & M. L. Co., 363 Chestnut, Brooklyn, N. Y. ..... H ..
Cooley Mfg. Co., 98 Park Place, New York .. W .. .. ..
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City..... .. ..
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. ..... H .
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa. ....
Eureka Copper Products Corp., North East, Pa. .... W S H .
Fleck Carbon Co. 508 Broome, New York C .. ..
General Electric Co., Schenectady, N. Y.... C .. .. H .
Graphalloy. See Graphite Metalizing Corp.
Graphite Metalizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. ..... C .. .. H ..
Henrite Products Co., 98 Park Place, New York, N. Y. ..... C .. ..
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio .... H ..
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) ..... C .. ..
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. ..... C .. ..
Kohlenite Products Co., 417 W. 23th, New York, N. Y. ..... C .. ..
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C .. ..
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. ..... C .. ..
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. ..... C .. ..
National Carbon Co., Cleveland, O. ..... C .. ..
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. ..... C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co. 8215 Almira Ave., Cleveland, Ohio ..... C W L
Ohio Elec. Specialty Mfg. Co., Troy, O.... .. W .. .. ..
Perfection Supply Co., 98 Park Pl., New York, N. Y. ..... C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. ..... C .. ..
Pure Carbon Co., Wellsville, N. Y..... C W S .. L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. .... W L
Salem Electrical Supply Co., Salem, Mass. .. W .. .. ..
Seabury, Ralph L., Factories Bldg., Toledo, O. C .. ..
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. ..... C .. ..
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. ..... C L
Speer Carbon Co., St. Mary's, Pa. ..... C .. ..
Stackpole Carbon Co., St. Mary's, Pa.... C .. ..
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. ..... C .. ..
U. S. Graphite Co., Saginaw, Mich. ..... C .. ..
Universal. See Graphite Metalizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L
BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 33 Crawford, Newark, N. J.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.
BUNCHING MACHINES. See Wire Manufacturing Machines.
BUSHINGS, SHAFT. See Bearings and Bushings.

BUSHINGS, Box and Cabinet, Porcelain

Appleton Electric Co., 1704 Wellington Ave., Chicago, Ill.
Columbia Metal Box Co., 226 E. 144th St., New York, N. Y.
Harter. See Multi Elect. Mfg. Co.
Knox Porcelain Corp., Knoxville, Tenn.
Mineralite Electric Co., 25 N. Peoria, Chicago, Ill.
Multi Electric Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Nelson Elec. Co., Plant City, Fla.
CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Fibre

Diamond State Fibre Co., Bridgeport, Pa.
Vulcanwood. See Diamond State Fibre Co.
CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 555 W. Monroe, Chicago, Ill
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.

DIE CASTINGS

Permanent Mould Castings

OUR 36 years' experience in DIE-CASTING enables us to give you QUALITY and SERVICE. ALLOYS the very best used in all castings closely checked by our own METALLURGIST. Let our engineering department explain the savings possible in the use of die castings. We design and make our own DIES. QUOTATIONS made on parts NICKEL or CHROME plated. GOOD WILL reflects as an index to our large number of satisfied customers.

FRANKLIN DIE CASTING CORPORATION
826 Gifford St., Syracuse, N. Y.
Pioneers of the Die-Casting Industry

Dowman-Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Box & Switchboard Co., 500 S. Thorp, Chicago.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dall Mfg. Co., 406 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mcaher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Reznoh. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 238 46th, Brooklyn, N. Y.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Colt, Irvington.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood

Ampere. See Donohue Lumber Co.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 83rd St., Cleveland, O.
Buckeye Mfg. Co., Springfield, O.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Dexter Co., Geo., Henderson, Ky.
Donohue Lumber Co., Smith and State, Perth Amboy, N. J.
Effein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Bano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Oneida Cabinet Corp., Oneida, N. Y.
Ottawa Furniture Co., Holland, Mich.
Pierson Co., 836 Cedar, Rockford, Ill.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago.
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pilliied Lumber Co., Swanton, O.
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R. E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schutz Bros., 152 Chambers, New York, N. Y.
Signal Elec. Mfg. Co., 1904 Broadway, Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Stradivara Co., Coshocton, Ohio.
Stettner Phonograph Corp., 318 E. 75th, New York.

DIE CASTINGS

ELIMINATE MACHINING

WHY NOT SEND YOUR INQUIRIES TO US?

Twin City Die Castings Co.
Talmage and 33rd Aves., S. E.
MINNEAPOLIS, MINN.

DIE MOLDED CASTINGS

IN

Aluminum, Tin, Zinc and Lead Alloys

Send Samples or Blueprints for Quotations

Get Our Prices
They Will Interest You

BADGER DIE CASTING CO.,
156 East Buffalo St., Milwaukee, Wis.

Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 23th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass.
CABLE ARMORING MACHINES. See Wire Manufacturing Machines.
CABLE TEST SETS. See Instruments, Portable and Switchboard.
CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington,
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibre Products Co., New Bedford, Mass.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibre Products Co.
CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.
CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Are Light.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.
CARTONS. See Boxes and Wrappers.
CASEIN PLASTICS. See Molded Insulation.
CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.
CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Quality Aluminum Casting Co., Waukesha, Wis.
Veco Mfg. Co., South Norwalk, Conn.

CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Bohn Aluminum & Brass Corp., 2512 E. Grand Blvd., Detroit.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Faries Mfg. Co., Decatur, Ill.
McGill Metal Co., Valparaiso, Ind.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Rabun Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.

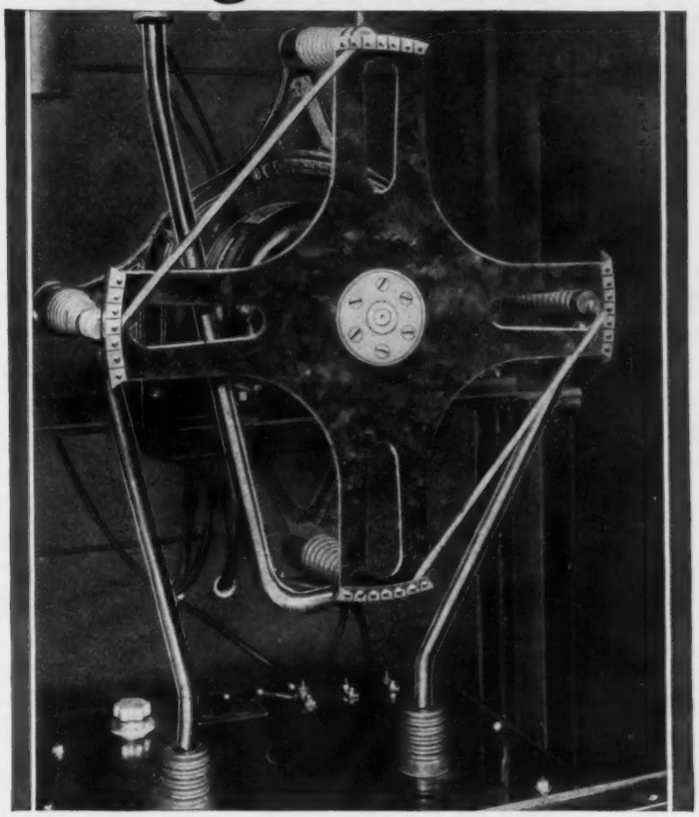
CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumae. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh
Aluminum Industries, Inc., 2438 Beekman, Cincinnati, O.
American Die Casting Co., 2040 Dominick, Chicago, Ill
Badger Die Casting Co., 156 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Throop St., Chicago.
Do-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y
Franklin Die Casting Corp., 826 Gifford, Syracuse, N. Y.
Illinois Die Castings Co., 503 S. Jefferson, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis
Newton Die Casting Corp., 146 Munson, New Haven, Conn.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio
Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J
Barnett Foundry Co., Newark, N. J.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.

High voltage rectification!



. . . surface leakage and breakdown minimized by Micanite . . . .

Centrifugal strains and electrical stresses combine in the whirling disc of this rectifier to produce an unusual burden. Tests made with discs of various shapes, of many different materials, proved conclusively that only Micanite satisfied both the electrical and mechanical demands. Through years of use Micanite has proven its superiority for this severe service.

Electrically, mechanically and chemically Micanite possesses many outstanding characteristics that are of vital importance for commutator segments and rings; underground cable joints; heater plates; condenser plates and thousands of other widely varying uses. If your product requires electrical insulation the chances are that it can be moulded or stamped from Micanite to meet precisely your specifications. Our engineering advisory service is at your disposal.

MICA INSULATOR COMPANY
New York: 200 Varick Street. Chicago: 542 So. Dearborn St. Cleveland, Pittsburgh, Cincinnati, San Francisco, Los Angeles, Seattle; Toronto, Montreal. Works: Schenectady, N. Y. London, Eng.

PERFECT MICANITE INSULATOR REG. U.S. PAT. OFF.

Electrical INSULATION

PERFECT EMPIRE INSULATOR REG. U.S. PAT. OFF.

MICA INSULATION OILED CLOTH INSULATION

CASTINGS, Gray Iron—Continued
North Wales Mach. Foundry Co., North Wales, Pa.
Sachs Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
Snead & Co., Pine St., Jersey City, N. J.
St. Louis Malleable Castings Co., 1701 N. Conduit Ave., St. Louis, Mo.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 31 N. Third, Minneapolis.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain

Airlox Rubber Co., 6807 N. Clark, Chicago, Ill.
Anchorlute. See Technical Products Co.
Carricite. See Airlox Rubber Co.
Fire Lute. See Technical Products Co.
Fuselli. See Airlox Rubber Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Thermold. See Technical Products Co.
CHAIN, Chandelier (Fancy). See Crystals, Chandelier.
CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

American High Speed Chain Co., Sandusky, O.
Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 12 Wooster St., New York.
Read Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.
CHANDELIER BEADS. See Crystals, Chandelier.
CHANDELIER CRYSTALS. See Crystals, Chandelier.
CHANDELIER FRINGE. See Crystals, Chandelier.

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Eimer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic

Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS

Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 517 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takamine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Ward Leonard Elec. Co., Mount-Vernon, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal

Oakite Products, Inc., 26 Thames, New York, N. Y.
CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug

Gray Bros. Co., Piano, Ill.
CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH UNTREATED

Boyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc
Lindall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth).

CLOTH AND PAPER, Insulating

Cloth, Insulated .....See C
Paper, Insulated .....See P
Fibre Paper (Fish Paper) .....See F
Press Board (Fuller Board).....See B
Silk .....See S

Acme Wire Co., New Haven, Conn.....	C	S	P	.	.
Armco. See Rogers Paper Mfg. Co.					
Armatite. See Mica Insulator Co.					
Brand & Co., Wm., 268 Fourth Ave., New York			P	.	.
Campbellite. See Campbell Fibre Co.					
Campbell Fibre Co., Stanton, Delaware.....					B
Carboloid Products Corp., 15 Park Row, New York, N. Y.....		C	.	P	.
Case Brothers, Inc., Highland, Park, Conn.			P	.	B
Case Mfg. Co., Unionville, Conn.....			P	.	.
Case & Risley Press Paper Co., Oneco, Conn.					
C-F. See Campbell Fibre Co.					
Celoron Co., Bridgeport, Pa.....			P	F	B
Chicago Mica Co., 345 Campbell Ave., Valparaiso, Ind.		C	.	.	.
Dexstar. See Dexter & Sons.					
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)					
Diamond State Fibre Co., Bridgeport, Pa..			P	.	.
Dielectric Mfg. Co., St. Louis, Mo.....	C	S	P	.	B
Federal Insulating Corp., Yonkers, N. Y....	C	.	P	F	.
Fyberoid. See Wilmington Fibre Specialty Co.					
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn.....		C	.	P	.
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).					
Hewitt & Bros., C. B., 16 Ferry, New York	C	.	.	P	.
Hi-Tex. See Stevens Paper Mills.					
Incella. See Tarentum Paper Mills Co.					
Irvington Varnish & Insulator Co., Irvington, N. J.	C	S	P	.	.
Manning Paper Co., J. A., Troy, N. Y.					B
Mica Insulating Co., 200 Varick, New York	C	S	P	.	B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.			P	.	.
National Vulcanized Fibre Co., Wilmington, Del.				F	.
New Jersey Wood Finishing Co., Woodbridge, N. J.		C	.	.	.
Ohmoid. See Wilmington Fibre Specialty Co.					
Old Hick. See Hewitt & Bros., C. B.					
Peerless. See National Vulcanized Fibre Co.					
Rogers Fibre Co., 210 Lincoln, Boston, Mass.				F	.
Rogers Paper Mfg. Co., South Manchester, Conn.					B
Schweitzer, Inc., Peter J., 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)					
Scutan Co., 342 Madison Ave., New York			P	.	.
Sico. See Standard Insulation Co.					
Standard Insulation Co., Rutherford, N. J.	C	S	P	.	.
Sterling Fibreboard Co., 501 Fifth Ave., New York (Varnished Hard Fibreboard).....					B
Sterlite. See Sterling Fibrebard Co.					
Stevens Paper Mills, Windsor, Conn.....					B
Tarentum Paper Mills Co., Tarentum, Pa.....			P	.	.
Turbonite. See Brand & Co., Wm.					
Union Mills Paper Mfg. Co., New Hope, Pa.			P	.	.
Warren Mfg. Co., 342 Madison Ave., New York, N. Y.			P	.	.
West Virginia Pulp & Paper Co., 200 5th Ave., New York.....					B
Wilmington Fibre Specialty Co., Wilmington, Del.			P	.	.

CLUTCHES, Magnetic

Cutler-Hammer Mfg. Co., Milwaukee. Wis.

COIL (Coils).

Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Taping Machines. See Taping Machines, Coil.
Tesla. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished

Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York,
A. & A. See Electrical Coil Winding Co.

Dies for MICA Stampings

We specialize in making dies for cutting mica with the least amount of waste. Accurate workmanship guaranteed.

MARECK & NEBEL
Tools, Dies and Special Machinery
255-57 Greenwich St., New York Walker 4799

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Coilton Elec. Mfg. Co., Easton, Pa.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden,
Electrical Products Mfg. Co., Providence, R. I.
Irvington Varnish & Insulator Co., Irvington, N. J.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Coil Co., 226 High, Newark, N. J.
Pifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Sevison Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stunz & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2342 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
U. S. Armature Service Co., 1617 S. Michigan Ave., Chicago, Ill.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittier & Ditmar, Inc., 1611 Beacon, Brookline, Mass.

COMMUTATOR

Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator.
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator.
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS

Derby Commutator Co., Derby, Conn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.
COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator

Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.
CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor

Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson & Co., C. J., 212 W. Austin, Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
B-G Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dinkey. See Elec. Controller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
Diamond Elec. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 515 Greenwich, New York, N. Y.
Industrial Controller Co., S. Pierce & Hanover, Milwaukee, Wis.
Malmin Co., H., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Switcholone. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.
COPPER. See Brass, Bronze and Copper; also Castings
COPPER TUBING. See Tubing, Brass and Copper.
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Es-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)

American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Firelite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitreomil. See Thermal Syndicate.
COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)

Bartlett Hayward Co., Baltimore, Md
Bond Co., Charles, 617 Arch, Philadelphia, Pa.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Grundy. See Bond Co.
Lips, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill.
Mather. See Bond Co.

INSULATORS *made of* LAVA

In the manufacture of Electrical appliances, experience has proven the superiority of Lava as an insulator.

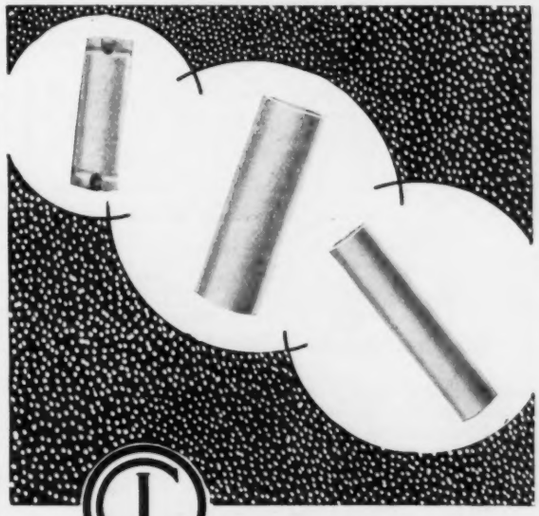
Made accurately to special design, Lava parts are uniform and dependable.

AMERICAN LAVA CORPORATION

1425 William Street Chattanooga, Tenn.

Manufacturers of

Heat Resistant Insulators



"QUALITY"

SPECIAL PORCELAIN

Refractory Tubes for Every Purpose

COLONIAL INSULATOR CO.

AKRON, OHIO *Established 1892*

KEEPING PACE WITH THE INDUSTRY

Through a resourcefulness in manufacturing methods and processes, comparable to those developed within the electrical industry itself—MICABOND has developed outstanding electrical, chemical and mechanical properties which more than ever stamp it as the Standard Mica Insulation.

For more than 29 years MICABOND has kept step with the rapid growth of the industry. As higher voltages and greater stresses were encountered, Micabond met each new condition with a quality that has insured manufacturers against insulation troubles.

Micabond is furnished in sheets, strips, tubes, tape and specially punched or moulded parts to specification.

Let us tell you more about the advantages of Micabond—Send your blue prints or specifications for prices.

CHICAGO MICA CO.
345 Campbell Street
VALPARAISO, INDIANA

53%

More than 53% of the automobile models for 1929 production will have starting and lighting motors and generators that are insulated with

MICABOND

MICABOND THE STANDARD MICA INSULATION

COUPLINGS, Shaft (Flexible Insulated)—Continued
Nuttall Co., R. D., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark, N. J
Webster Mfg. Co., 1856 N. Kostner Ave., Chicago, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa.
COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease

Bowen Products Corp., Auburn, New York.
Lunkenheimer Co., Cincinnati, Ohio.
CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.
CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier

Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago
Hirschberg, Shutz & Co., 258 4th Ave., New York, N. Y (Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia
Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.
CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA

Meyercord Co., 133 W. Washington, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y

DIALS

Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled

Whittier Co., Horace R., Pequabuck, Conn.
DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.
DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS

Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Donly Machine Specialties Co., 2104 S. 52nd Ave., Chicago, Ill.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature

Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y
Lamination Stamping Co., 764 Windsor, Hartford, Conn.
DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady, [illegible]
EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.

ELECTRODES FOR GAS SIGNS

Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Manhattan Elecl. Supply Co., 17 Park Place, New York, N. Y.
ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.
ELEMENTS, Heating. See Units, Rods and Grids.

ENAMELING MACHINES (For Magnet Wire)

(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.

ENGRAVING MACHINES

Portable Bench and Pedestal Outfits for Marking Metal.
Brewster Co., Wm., 30 Church, New York, N. Y.
Deckel. See Preis & Co., Inc., H. P.
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchorraph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel

Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
(Tube Base Branders).
Etch-O-Gravure. See Insuline Corp. of America.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati.
Wright Radio Co., 114 Exchange, Rockland, Mass.

EYELETS

Platt Bros. & Co., Waterbury, Conn.
Waterbury Brass Goods Co., Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.
FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.
FEET, FELT. See Felt.

FELT

Advance Felt & Cutting Co., 317½ S. Jefferson, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 379 20th, Brooklyn, N. Y.
Western Felt Wks., 4031 Ogden Ave., Chicago, Ill.

FERRULES

Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Rladon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.

FIBRE BOARD PRODUCTS (Solid and Corrugated)

Container Corp. of America, 111 W. Washington, Dept. 36, Chicago, Ill.

FIBRE—*cut to any form*
Sheet, Rod, Tubing
MICA
VARNISHED CLOTH
COTTON TAPES AND SLEEVING
Everything for the Motor
Send for New Insulation Catalogue
THE CONSUMERS RUBBER CO
CLEVELAND 1302-4-6 ONTARIO ST.
CHICAGO 320 WRIGLEY BLDG.

Mid-West Box Co., Dept. 6, 111 W. Washington, Chicago.
Sefton Mfg. Corp., 59 E. Madison, Chicago, Ill.
FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol

Moisture Proof; Sheet, Rod, Tubes.
Armite. See Spaulding Fibre Co.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa.
Continental Fibre Co., Newark, Del.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized

Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Conite. See Continental Fibre Co.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Diamond State Fibre Co.
Diamond State Fibre Co., Bridgeport, Pa.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Pantasote Co.
Fibre Products Co., New Bedford, Mass.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Pantasote Co., Inc., 250 Park Ave., New York, N. Y.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Diamond State Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.
FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp

Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Sirian Wire & Contact Co., 255 Sherman Ave., Newark.
Suter & Nuetzi, 3709½ Lisbon Ave., Milwaukee, Wis.
Vacuum Tube Products, Steneck Trust Bldg., Hoboken, N. J.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J.
(Lead-in-Welds.)

FILES, Commutator Slotting

Ideal Commutator Dresser Co., 1008 Park, Sycamore, Ill.
Martindale Electric Co., 1264 W. Fourth, Cleveland, O.
FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps . . . . . H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) . . . . . B . . . . .
American Pin Co., Waterbury, Conn. . . . . I . . .
American Ring Co., Waterbury, Conn. (Candle.) . . . S . .
Ampinco. See American Pin Co.
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. . . . . B I . . .
Arco. See American Ring Co.
Arrow Electric Division of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . S . .
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit.. B . . . . .
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 86 Walker, New York. . . . . B . . . . .
Blandt Mfg. Co., 3727 Gratiot Ave., Detroit. B . . . . .
Braun, J. G., 609 S. Paulina, Chicago, Ill. (Pressed Ornaments.) . . . . . B I . . .
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) . . . . . B I . . H
Cambridge Brass Co., Cambridge, Mass. . . . . B . . . . .
Chase Brass & Copper Co., Waterbury, Conn. B . . S . .
Cleanesy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. . . . . B . . S . .
Crescent Brass Mfg. Co., Reading, Pa. . . . . B . . . . .
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. . . . . S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) . . . . . I . . .
Dunlap Co., John, Carnegie, Pa. . . . . S . .
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. . . . . B . . . . .
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. . . . . S . .
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. . . . . B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago.. . . I . . .
Fralick Co., S. R., 15 S. Clinton, Chicago.. . . I . . .
Franklin Brass Foundry Co., Reading, Pa. . . . B . . . . .
Friedley-Voshardt Co., Chicago. . . . . B . . . . .
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. . . . . I . . .
Hart & Hegeman Mfg. Co., Hartford, Conn. . . . S . .
Incandescent Supply Co., 468 West Broadway, New York, N. Y. . . . . B . . . H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Liberty Brass Turning Co., 83 Walker, New York, N. Y. . . . . I . . .
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. . . . . B I . . .
Liberty Machine Co., Wauwatosa, Wis. . . . . B I . . .
Light Metal Stamping Co., 310 13th St., West New York, N. J. . . . . S . .
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. . . . . H
L. & W. Brass Wks., 820 Orleans, Chicago, Ill. B . . . . .
Madelite. See Nelson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. . . . . I . . .
Metal Products Co., 210 Canal, New York. . . B . . . . .
Metro Iron Ornament Co., 191 Christie, New York, N. Y. . . . . I . . .
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. . . . . B . . . . .
Midwest Elec. Co., 1639 Walnut, Chicago, Ill.. . . I . . .
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. . . . . B . . . . .
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. . . . . S . .
Monarch. See Perfecilite Co.
Murlin Mfg. Co., Philadelphia, Pa. . . . . B I . . .
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) . . . . . I . . .
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. . . . . H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 563 Broadway, New York, N. Y. . . . . B . . . . .
Nobolt. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. . . . . I . . .
Onli. See Perfecilite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B . . S . .
Perfecilite Co., 1457 E. 40th, Cleveland. . . . . S . .
Pittsburgh Valve & Fittings Co., Barberton, O. . . I . . .
Plume & Atwood Mfg. Co., Waterbury, Conn. B . . S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Reading Brass Co., 141 Schiller, Reading, Pa. B I . . .
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. B . . . .
Rodale Mfg. Co., 200 Hudson, New York. . . . B . . . H
Sandow Tool Co., 1440 Bway, New York, N. Y. . . . S . .
Scovill Mfg. Co., Waterbury, Conn. . . . . B I . . .
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. . . . . S . .
Standard Metal Spinning Co., 123 Mott, New York, N. Y. . . . . B . . . . .
Star. See Perfecilite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. . . . . I . . .
Steele & Johnson Mfg. Co., Waterbury, Conn. B . . S . .
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) . . . . . B . . . . .
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York. . . . . I . . .
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. . . . . B . . . . .
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B . . . . .
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. . . . . B . . . . .
Walden Tool & Metal Mfg. Co., New Haven Conn. . . . . .
Wameco. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. . . . . B . . . . .
Waterbury Metal Wares Co., Waterbury, Conn. . . . S . .
Weber Brass Co., Whitney Power Block, Cleveland, O. . . . . B . . . . .
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. . . . . B . . S . .
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. . . . . B . . . . .
Zamora. See American Pin Co.

FLASHERS, Sign

Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco, Cal.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.

REFRACTORIES that you can rely upon!

The illustration below shows the interior of a large electric furnace for the Westinghouse Electric and Manufacturing Company

Our business is the making of refractory heating element supports for electric furnaces such as that illustrated here; also a full line of refractories for electric ranges and other domestic appliances. Another important branch of our production consists of a special line of tubes and cores, both threaded and plain, for all types of resistance windings.

The fact that we make these refractories for the leading organizations in the country shows that we know our business—our products carry a guarantee that insures their dependability.

"Quality, service and cooperation" is our three-ply motto, and you can rely on getting it fully in every job. A visit to our modern completely equipped plant will illustrate perfectly the sound success of our methods.

The Electrical Refractories Co.

East Palestine, Ohio

The Beacon

guiding you straight to porcelain satisfaction

Porcelain buying is not a gamble or a matter of guess work if you specify or insist upon getting STAR Quality. Star Porcelain is real quality and yet the price is as low as some inferior kinds. Let STAR Quality guide you.

The STAR PORCELAIN COMPANY TRENTON NEW JERSEY

Akron Porcelain

We are specializing in quality porcelain of special design, and our modern equipped plant enables us to quote favorable prices.

THE AKRON PORCELAIN CO.

Formerly The Mogadore Insulator Co.

Akron, Ohio

FLASHERS, Sign—Continued
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 516 Greenwich, New York, N. Y.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Magnetic Sign Flasher Co., Seattle, Wash.
Mercury. See Betts, Inc., James H.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.

FLEXIBLE SHAFT MACHINES
(For shafting. See Tubing, Flexible Metallic.)
Strand & Co., N. A., 5001 N. Lincoln, Chicago, Ill.

FORGINGS, Non-Ferrous
Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire
Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport, Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Kricher's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.

FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Waterbury Brass Goods Co., Waterbury, Conn.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY: Cartridge—See C; Plug—See P; Non-Refillable—See N; Refillable—See R; Open Link—See O; Fuse Wire—See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J.	P
Arkless. See Economy Fuse Mfg. Co.	
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.	P N
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa.	P
Blue Ribbon. See Royal Elec. Co.	
Buss. See Bussmann Mfg. Co.	
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis	C P N R O
Chase-Shawmut Co., Newburyport, Mass.	C P N R O
Chicago Jefferson Fuse & Electric Co., 1505 W. 15th St., Chicago, Ill.	C P N R O
Clearsite. See Economy Fuse & Mfg. Co.	
Clear-Top. See Trico Fuse Mfg. Co.	
Colortop. See Trico Fuse Mfg. Co.	
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile)	C N R
Cote Bros. Mfg. Co., 182 W. Lake, Chicago	C P R
Crystal. See Royal Elec. Co.	
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkiss, Pittsburgh	C E
D. & W. See Graybar Electric Co.	
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill.	C P N E
Eco. See Economy Fuse & Mfg. Co.	
Electric Fuseguard Co., Charlottesville, Va.	C P N R
Elliott Electric Co., Shreveport, La.	
Gem. See Chicago-Jefferson Fuse & Electric	
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn.	C P N R
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y.	C
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y.	C R
H. & H. See Hart & Hegeman Mfg. Co.	
Hart & Hegeman Mfg. Co., Hartford, Conn.	P R O
Hudson Wire Co., Ossining, N. Y.	
Kantark. See Trico Fuse Mfg. Co.	
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y.	C P N O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.)	
Monarch Fuse Co., Jamestown, N. Y.	C N R
National. See Economy Fuse & Mfg. Co.	
Neark. See Colt's Patent Fire Arms Mfg. Co.	
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y.	C P R
Platt Bros. & Co., Waterbury, Conn.	O
Powell, F. W., 119 W. Ohio, Pittsburgh	P R
Ree-Nu-It Elec. Co., New Bedford, Mass.	C P R
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y.	C R
Royal Elec. Co., Chelsea Station, Boston	P N
Shawmut. See Chase-Shawmut Co.	
Simplicity. See Cote Bros. Mfg. Co.	
Six-in-One. See Industrial Engrg. Co.	
Star Fuse Co., 235 Canal, New York, N. Y.	C P R
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee	C P N R
Union. See Chicago-Jefferson Fuse & Electric	

GALVANIZING
Cattle & Bros., Joseph P., Gaul and Letterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS INERT
Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber
Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)
Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Co., R. D., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm
Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.

GEARS AND PINIONS, Composition
Celoron Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Diamond State Fibre Co., Bridgeport, Pa.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel
Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Perkins Machine & Gear Co., 120 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide
Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

GENERATORS, Electroplating. See Plating Generators.
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture.
GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes
Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE
Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Song, 105 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Beryllite. See Plaut & Co., L.
Cania. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Decora. See Macbeth-Evans Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Geneo. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kaufield Glass & Ceramic Co., Star City, W. Va.
King-Tutankhamen. See Macbeth-Evans Glass Co.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
MacBeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Melilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearltone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., 230 Fifth Ave., New York, N. Y.
Pilabrasgo. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestopal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells
Berin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Liberty Bell Mfg. Co., Minerva, O.
Reiter, G. C., Canton, O.

GRAPHITE BEARINGS. See Bearings, Oil-less.
GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GROMMETS. See Eyelets.
GROUND LOCATORS. See Instruments, Portable and Switchboard; also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons
Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

HOLDERS, Brush. See Brushes, Commutator.
HOT WIRE METERS. See Instruments, Portable and Switchboard.
IMPREGNATING COMPOUNDS. See Wax and Compounds
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments Incandescent Lamp.

INDICATORS, Operation
Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill

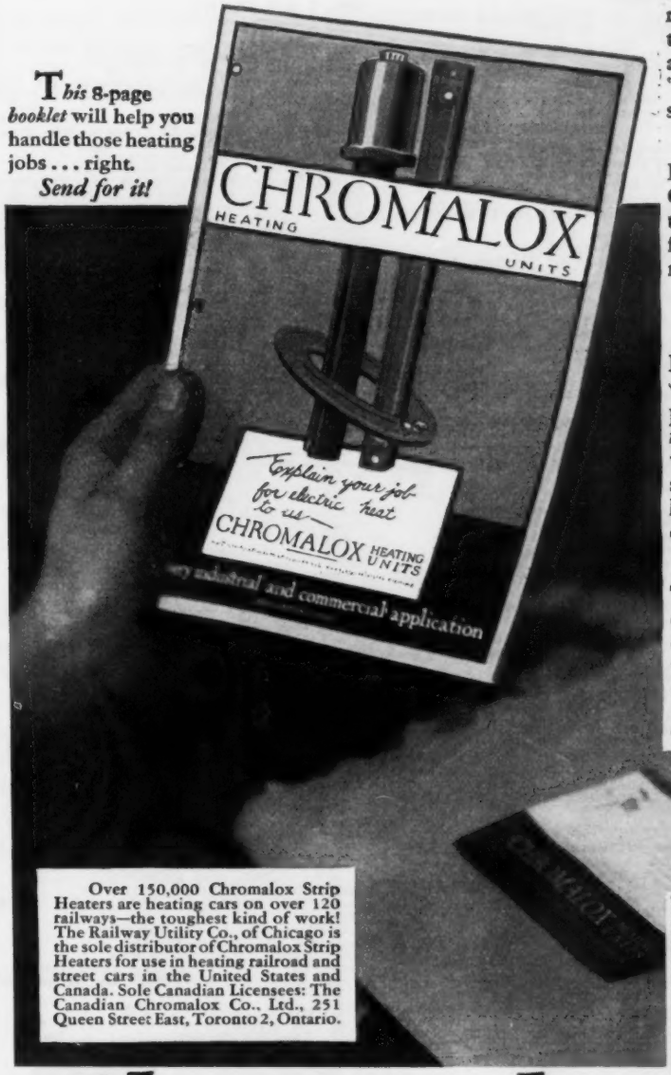
INDUCTION COILS. See Coils, Finished.
INSTRUMENT, Jewels. See Jewels.
INSTRUMENTS, Laboratory Standard. See Instruments Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard; also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard
Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kanson. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Milvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.

★ WRITE *for your* COPY ~

you'll find it helpful if you are designing *a New Product* or improving *an Old one..*

This 8-page *booklet* will help you handle those heating jobs . . . right. *Send for it!*



Over 150,000 Chromalox Strip Heaters are heating cars on over 120 railways—the toughest kind of work! The Railway Utility Co., of Chicago is the sole distributor of Chromalox Strip Heaters for use in heating railroad and street cars in the United States and Canada. Sole Canadian Licensees: The Canadian Chromalox Co., Ltd., 251 Queen Street East, Toronto 2, Ontario.

Are you in the midst of designing a new product and wondering about the heating unit—what's the right size, type and rating? Or are you ironing out the rough spots in an otherwise good electrical appliance or some equipment, that would be a "best seller" if only the heating unit were what it should be?

Then you'll want a copy

In it are priced and pictured the many sizes of Chromalox heating units being built into the electrically heated products of over 60 leading manufacturers of appliances . . . ranges . . . hotel and restaurant equipment . . . industrial equipment.

How you profit by having us work with you

Each of the manufacturers with whom we have worked have saved time and money in costly experiments, both with their products—and with *their customers.* Most of them called us in to help with the final design of their product. In all instances, we showed them the *right* way of building heating units into their products so that their products would *stay sold.*

But what about your products?

Tell us about your developments. No doubt we could do some helpful things for you as we have done for dozens of other manufacturers. It's surely worth considering. Mail the coupon now for your copy of this 8-page booklet—telling us about the appliances or equipment you want properly heated. There's no obligation.

★ . . . *mail with your letterhead!*

Edwin L. Wiegand Co., 422 First Ave., Pittsburgh, Pa.

YES, without obligation, send me a copy of this Chromalox bulletin and any other data that will help me determine what heating units should be used for

heating a _____

_____

_____

Signed _____ *Position* _____

(PLEASE WRITE PLAINLY)

Chromalox

ELECTRIC HEATING UNITS

INSTRUMENTS—Continued
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Vawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 583 Frelinghuysen Ave. Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Weston Elecl. Instrument Corp., 583 Frelinghuysen Ave. Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.
See Also Instruments, Pocket; Also Instruments, Laboratory Standard.
Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., 136 Liberty, New York, N. Y.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Ground-Ohmer. See Stiebt & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Master. See Jewell Elecl. Instrument Co.
M. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Weiford, Jr., Geo. W.
Nagel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elecl. Inst. Co., 81 Hilliard, Manchester, Conn.
Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Elsemann Shortfinder Co.
Standee. See Stiebt Co., H. H.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Stiebt & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Stiebt & Co., H. H.
Two-in-One. See Stiebt Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)
Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate.
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint and Varnish.
Paper. See Cloth and Paper Insulating
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS

Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS

Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

GLASS SPECIALTIES
COLORED
SIGNAL LENSES

Investigate Our Facilities
QUALITY—SERVICES—PRICES

ROCHESTER GLASS PRODUCTS COMPANY

29 N. Water St., Rochester, N. Y.

INSULATORS, Canopy

Diamond State Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Macallen & Foundry, Boston, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass

For Composition Jars. See Molded Insulation; also Rubber.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing

Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

JOINTS, Fixture Insulating

Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Macallen & Foundry, Boston, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., O. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)
Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer.
Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES

(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.
LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

LENSES

Sign Letter, Flashlight, Projector and Reflector.
Bausch & Lomb Optical Co., 635 St. Paul, Rochester, N. Y. (Condensing and Projection Lenses.)
B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Consolidated Lamp & Glass Co., Coraopolis, Pa. (Flashlight)
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa. (Flashlight.)
North Lights Co., 20 W. 15th, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products Co., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)

• MICA •

We cut, punch or split mica to any specification, also furnish Raw Mica in all sizes and qualities. Quotations cheerfully given.

COLONIAL MICA COMPANY
136 7th Street Jersey City, N. J.

LETTERS, Sign

Glass. Metal.
Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs, Inc., 2736 Wentworth Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 17 Park Place, New York, N. Y. (For Gas Signs.)
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature

Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket

Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.
LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

LOUD SPEAKERS

Manufacturers Units and Electric Pick-ups for Portable and Built-in Types.
American Reproducer Corp., 55 W. 42nd, New York, N. Y.
A. R. C. See American Reproducer Corp.
Amplion. See Woolf, J. W. & W. L.
Balsa Wood Reproducer Corp., 331 Madison Ave., New York.
Borkman Radio Corp., 152 E. Seventh, S. Salt Lake City, Utah.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dreher & Son, Chas., 157 Spring, New York, N. Y.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 42nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 338 N. Kedzie Ave., Chicago, Ill.
Lata Balsa. See Balsa Wood Reproducer Corp.
Magnavox Co., 4259 Horton, Oakland, Cal. Also Units.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Miles Mfg. Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Mozart-Radioceive. See Fergus Co.
Newcombe-Hawley, Inc., St. Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powerola. See Temple Corp.
Purepower. See Platter Cabinet Co.
Quam Radio Corp., 9703 Cottage Grove Ave., Chicago, Ill.
Racon Elec. Co., 18 Washington Place, New York, N. Y. (Horn only.)
Radio Cabinet Co., 2118 Gale, Indianapolis, Ind.
Raliotive Corp., 21st Ave. and 53rd, Brooklyn, N. Y.
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Sucboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 1925 S. Western Ave., Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
Ultratone Mfg. Co., 1046 W. Van Buren, Chicago, Ill.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Vitalitone Radio Corp., 88 University Place, New York
Wonderphone. See Universal High-Power Telephone Co.
Woolf J. W. & W. L., 227 Fulton, New York, N. Y.
Zisch Engineering Corp., Newark, N. J.

LUGS, Copper

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.
Dante Elecl. Mfg. Co., Bantam, Conn.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

LUMINOUS SPECIALTIES

KEY
Luminous Compound .....See C
Pendants (Bulbs) .....See P
Standard Parts .....See S
Acornlite Studios, 675 72nd, Brooklyn, N. Y..... P
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn..... S P
Bryant Electric Co., Bridgeport, Conn..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn..... S
Cutler-Hammer Mfg. Co., 1488 St. Paul Ave., Milwaukee, Wis.
Eagelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y..... P
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn. ..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman Mfg. Co., Hartford, Conn..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn..... P

The Pulse Beat of Our Time

In our amazing industrial age obsolescence eliminates the proudest mechanical triumphs years before they have outlived their usefulness.

More potent, surer and more economical methods appear, and we suddenly find it infinitely more profitable to install the new creations.

Binding together the structure of this mechanical age—themselves the sinews of American industry—The Continental Fibre Company's products have ever kept pace with the new needs of production.

The quality and reputation of Continental products are based upon research, experiment, and analysis—constant testing of the old, and constant striving for the new and more effective way.

THE CONTINENTAL FIBRE COMPANY

NEWARK, DELAWARE

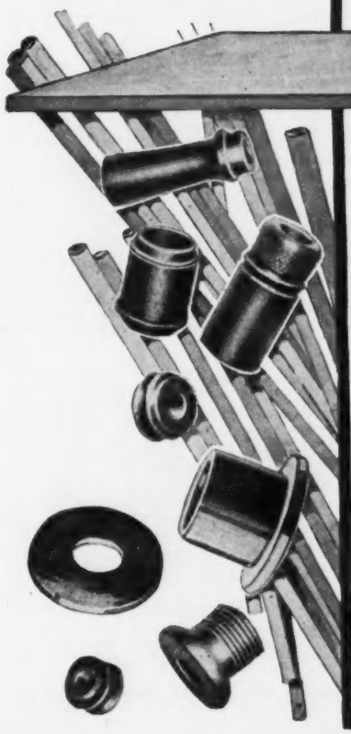
Service From:

New York . 250 Park Ave.
Chicago . . Wrigley Bldg.
San Francisco . 1575 Folsom St.
Los Angeles . 307 S. Hill St.
Seattle . 1520 Fourth Ave., So.

Sheets, Rods, Tubes and

WILMINGTON FIBRE

Special Shapes



To electrical manufacturers who require fibre insulation of quality, accuracy and uniformity, produced at high speed and low prices, Wilmington offers an incomparable service.

The largest makers of fibre specialties in the world, we have the facilities for handling any quantity or shape in fibre. Our punching department has a capacity of three millions a day; and our experience will enable you to save in unexpected ways in many cases.

The Wilmington organization is geared to modern fibre insulation needs; and yet the care we take in producing only the finest-seasoned fibre sheets, rods and tubes is thorough and unexcelled.

WILMINGTON FIBRE SPECIALTY COMPANY

Wilmington, Del.

The world's largest makers of fibre specialties

We can make one or a million for you *-quickly!*

BAKELITE MOULDERS

SHAW

FOUNDED 1892

Insulator Company

IRVINGTON, NEWARK, NEW JERSEY

"Quality that Qualifies"

We are Custom Moulders of

Bakelite *and* Durez Parts

NORTON LABORATORIES, Inc.,

1025 Mill St., Lockport, N. Y.

We can help you on

MOLDING *in* BAKELITE—

Our molding is supervised by an electrical engineer, and your specifications and special problems will have our closest attention.

RECTO MFG. CO.

23 W. 3rd St.

Cincinnati

Ohio

LUMINOUS SPECIALTIES—Continued

Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa.... C .. P
Reynolds Spring Co., Jackson, Mich..... .. S .. P
Rodale Mfg. Co., 200 Hudson, New York, N. Y..... .. P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. ..... C S P

MACHINE SCREWS. See Screws, Machine.

MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES

Armature Banding. See Banding Machines, Armature
Armature Notching. See Notching Machines, Armature
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

MACHINES, Lamp Making

For Making Incandescent Lamps and Vacuum Tubes.
Arrow Mach. Co., 527 Hackensack Plank Rd., Union City, N. J.
Berrenberg, R., 12 Farnham (Roxbury), Boston, Mass (Vacuum Pumps.)
Dwyer Machine Co., Lynn, Mass.
Fisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York. N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines

MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.

MAGNET CHARGERS. See Chargers, Magnet.

MAGNET STEEL. See Steel, Magnet.

MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.

MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.

MAGNETIC CHUCKS. See Chucks, Magnetic.

MAGNETIC CLUTCHES. See Clutches, Magnetic.

MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent

Bullens Co., D. K., Pottstown, Pa.
Ind. Steel Products Co., 4545 S. Western Blvd., Chicago
Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Stucht & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

MALLETS, Raw Hide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

MANGANESE, Battery. See Chemicals, Battery.

MEASURING INSTRUMENTS. See Instruments.

METAL CUTTING OUTFITS. See Welding and Cutting

MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.

MEGOHMMETERS. See Instruments, Laboratory Standard

MERCURY SWITCHES. See Switches, Mercury.

METAL CLEANERS (Compound). See Cleaners, Metal. Outfits.

METAL FINISHING. See Plating & Finishing.

METAL MARKING OUTFITS. See Engraving Machines.

METALLIC SHADES. See Shades, Metallic.

METERS. See Instruments.

MICA SHADES. See Shades, Mica.

MICA TAPE. See Tape, Mica.

MICA UNDERCUTTERS. See Slotting Machines & Tools Commutator.

MICA

Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., 345 Campbell Ave., Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Fillion., S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 14 Lispenard, New York, N. Y.
Hirsch Mica Co. 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 3660 Brandywine, Philadelphia, Pa
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Macallen and Foundry, Boston, Mass.
Micabond. See Chicago Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Minerals & Insulation Co., 101 Spring, New York, N. Y
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass.
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 957 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place. New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.

MIXERS, INSULATION. See Insulation Mixers.

MOLDED

Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.
Shades. See Molded Insulation.

MOLDED INSULATION

Aico. See American Insulator Corp.
Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., New Freedom, Pa.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmoid. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brownlite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celoron Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condenite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Cutler-Hammer Mfg. Co., 1388 St. Paul Ave., Milwaukee,
Dayton Insulating Moulding Co., 434 E. First, Dayton, Ohio.
Diemoulding Production Co., Canastota, N. Y.
Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinoid Co., Park Row Bldg., New York, N. Y.
Evercool. See Bakelite Corp.
Federal Insulating Corp., Yonkers, N. Y.
Fedrelin. See Federal Insulating Corp.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 116 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
Herculite. See Colosta Co.
Huetter-Premier Machine Co., 7215 Livernois Ave., Detroit, Mich.
Hi-Heet. See Insulation Mfg. Co.
Imperial Molded Products Co., 2925 W. Harrison, Chicago.
Imtroco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.

GARFIELD MOLDED COMPOSITIONS

Reduce Costs Strong Heat Proof

GARFIELD MANUFACTURING CO.

Garfield, N. J. *Established 1908*

Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., 404 Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Syria, O.
Johnson Molding & Tool Co., Weymouth, Mass.
Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Keystone Specialty Co., 2373½ Coventry Rd. (Lakewood), Cleveland, O.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Macallan Co., Macallan and Foundry Sts., Boston, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megohom. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 232 Greenwich, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norlox. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Composition Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmonol. See Bakelite Corp.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 304 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Star Insulate. See Insulation Mfg. Co.
Starite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
Waterbury Button Co., Waterbury, Conn.
Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MOLYBDENUM

Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.

MONEL METAL

International Nickel Co., 67 Wall, New York, N. Y.

MOTOR CONTROLLERS. See Controllers, Motor.

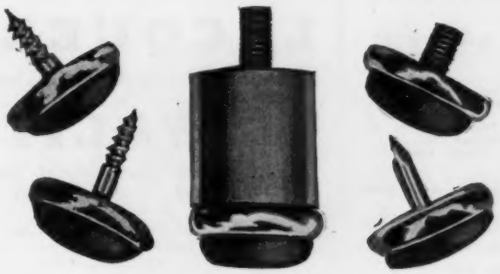
MOTOR PLATFORM BASES. See Bases, Motor Platform.

MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches, Snap (Heavy Duty).

MOTORS

Alternating Current .....See S
Direct Current .....See S
Motors, 1 Hp. up .....See M
Motors Fractional Hp. .....See F
Universal .....See U

Actodector. See Roth Bros. & Co.
Advance Elec. Co., 4311 Maple Ave., St. Louis M F S ..
Allis-Chalmers Mfg. Co., Milwaukee, Wis..... M .. S ..
Allis Co., Louis, Milwaukee, Wis..... M .. S ..
American Elec. Motor Co., Cedarburg, Wis..... M .. .. ..
Apex Elec'l Mfg. Co., 1067 E. 152nd, Cleveland .. F S U
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa. M .. .. ..
Baldor Elec. Co., 4352 Duncan Ave., St. Louis M F S ..
B-Line. See Brown-Breckmeyer Co.
Bodine Elec. Co., 2254 Ohio, Chicago..... .. F S U
Bogue Elec. Co., Chas. J., 132 King, New York M .. .. ..
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O..... M F .. ..
Burke Elec. Co., Erie, Pa..... M F S U
B. T. See Allis Co., Louis.
B & R Mfg. Co., 812 Lafayette, Toledo, O..... .. F .. ..
Century Elec. Co., 1806 Pine, St. Louis, Mo.. M F S ..
Chandeysson Elec. Co., St. Louis, Mo..... M .. S ..
Clark, Jr., Elec. Co., James, 600 E. Bergman, Louisville, Ky. ..... M .. .. ..
Cleveland Armature Wks., 4732 St. Clair Ave., Cleveland, O. ..... M .. S ..



Brawley

Felt Feet

Make products like radio cabinets or battery eliminators shock-proof, and easier to handle without scratching or marring polished surfaces. Brawley felt feet are more permanent in their protection, for they will not deteriorate, harden or break off. Furnished with wood screws, machine screws or nails.

Immediate shipment on all standard goods; and on special felt problems, you'll find our help valuable.

T. R. BRAWLEY

279 20th Street, Brooklyn, N. Y.

We'll make it for you—

..... anything from fibre tubing as a base

Brandywine Service includes the making of those "impossible" parts from best quality fibre, and keeping a high standard of accuracy and uniformity.

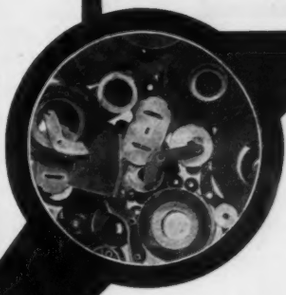
Yes—we ship Brandywine Fibre Tubing in standard mill lengths, cut-to-length pieces or machined and formed to order parts and pieces.

BRANDYWINE FIBRE PRODUCTS COMPANY

1402 *Walnut St., Wilmington, Del.*

Brandywine FIBRE

Standard Fibroc sheets are 36"x 42" any thickness.



Millions of intricate punched parts are produced at the Fibroc factory every month.

MORE THAN JUST INSULATION

In most applications, electrical insulation must be more than just an insulator.

It must be able to withstand sudden temperature changes, and extremes of heat and cold—be impervious to oil and moisture—be chemically stable, and must not deteriorate with age or from exposure.

Such insulation is FIBROC, and since with these qualities it combines great mechanical strength, thereby adapting it to many structural applications, many manufacturers find it the one material that successfully meets their requirements in every respect.

Fibroc is furnished in sheets, rods and tubes, or in the form of special punched or machined parts ready for assembly.

Fibroc silent gear material is furnished in sheets, blanks or in moulded gear blanks with or without metal hubs.

Specify FIBROC on your blue prints.

FIBROC

FIBROC INSULATION CO.

245 Lincoln Avenue

VALPARAISO, IND.

IMPERVIOUS

INSULATING VARNISH

Electrical Insulating Varnishes and Compounds

IMPERVIOUS VARNISH CO.

421 Wood St., Pittsburgh, Pa.

MOTORS—Continued

Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J. M .. S U
Cushman Elec. Co., Concord N. H. ..... M F S ..
Day-Fan Electric Co., Dept. A, Dayton, O. .... F S ..
Diehl Mfg. Co., Elizabeth, N. J. ..... M F S ..
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O. .... S U
Dumore. See Wisconsin Elec. Co.
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M .. S ..
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. ....
Electric Specialty Co., 221 South Stamford, Conn. M F S U
Electro-Dynamic Co., Bayonne, N. J. ..... M .. S ..
Emerson Electric Mfg. Co., 2015 Washington Ave., St. Louis, Mo. ..... M F S U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich. ..... M .. S ..
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill. ..... M F .. ..
Fidelity Elec. Co., Lancaster, Pa. ..... M F S U
Fitzgerald Mfg. Co., Torrington, Conn. .... F .. ..
Fynn Weichsel. See Wagner Elec. Corp.
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo. ..... F .. S ..
General Elec. Co., Schenectady, N. Y. ..... M F S U
Gilbert Co., A. C., New Haven, Conn. .... F .. U
Hamilton Beach Mfg. Co., Racine, Wis. .... F S U
Hobart Bros. Co., Troy, O. ..... M .. S ..
Holtzer-Cabot Elec. Co., 125 Amory, Boston... M F S ..
Howell Elec. Motors Co., Howell, Mich. ..... M .. S ..
Ideal Elec. & Mfg. Co., Mansfield, O. ..... M .. S ..
Imperial Electric Co., Akron, O. ..... M .. S ..
Janette Mfg. Co., 556 W. Monroe, Chicago. .... F S ..
Jantz & Leist Elec. Co., Cincinnati, O. ..... M F .. ..
Jeanin Electric Co., Toledo, O. ..... M F S ..
Kendrick & Davis Co., Lebanon, N. H. .... F S ..
Kimble Elec. Co., 634 N. Western Ave., Chicago M .. S U
Knapp Elec., Inc. (Div. of P. R. Mallory & Co.), Port Chester, N. Y. .... F S U
Leland Elec. Co., Dayton, O. .... F S ..
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio. ..... M .. S ..
Linc-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O. ..... M .. .. ..
Mando Co., Syracuse, N. Y. .... F .. ..
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis. .. F .. ..
Marble-Card Elec. Co., Gladstone, Mich. ..... M .. .. ..
Master Electric Co., Dayton, O. ..... M F S ..
MC. See General Electric Co.
Michigan Elec. & Mfg. Co., Lake Linden, Mich. .. F S ..
N. C. See Electric Controller & Mfg. Co.
Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y. .... F .. U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M .. .. ..
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio .... F S ..
O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M .. .. ..
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
Pow-R-Full. See Wagner Elec. Corp.
Reco. See Reynolds Electric Co.
Red Band. See Howell Elec. Motors Co.
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O. ..... M .. S ..
Reynolds Electric Co., 2650 W. Congress, Chicago .. F S ..
Robbins & Myers, Inc., Springfield, O. ..... M F S U
Rochester Elec. Products Corp., Rochester, N. Y. M .. S ..
Roth Bros. & Co., Chicago, Ill. ..... M .. S ..
Standard. See Robbins & Myers Co.
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J. ..... M .. S ..
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal. ..... M .. S ..
Stow Mfg. Co., Binghamton, N. Y. ..... M F S U
Sturtevant Co., 15 Devonshire (Hyde Park), Boston, Mass. ..... M F S U
Sunlight Electrical Mfg. Co., Warren, O. .... F S ..
Super Wick. See Master Elec. Co.
Switch start. See Lincoln Elec. Co.
Triumph Elec. Corp., Carthage, O. ..... M .. S ..
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa. ..... M F S ..
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles ..... M .. S ..
Valley Elec. Co., 4221 Forest Park Blvd., St. Louis, Mo. ..... M .. S ..
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo. ..... M F S U
Walter Elec. Mfg. Co., Norfolk, Va. ..... M .. S ..
Watson. See Allis Co., Louis.
Welco Uniframe. See Weseke Elec. Co., B. A.
Weseke Elec. Co., B. A., 1622 Vine, Cincinnati M F S ..
Westinghouse Elec. Mfg. Co., East Pittsburgh M F S ..
Willey-Wray Elec. Co., Cincinnati, O. ..... M .. S ..
Wisconsin Elec. Co., 59 16th, Racine, Wis. .. F .. U

22

Woods Mach. Co., S. A., Boston. ..... M F S ..
Zobell Elec. Motor Co., Garwood, N. J. ..... M .. S ..

NAME PLATES
See also Decalcomanis.
American Name Plate Co., 117 Imlay, Brooklyn, N. Y.
Angell Embossing Co., 37 Barney-Smith Co., Dayton, O.
Coloron Co., Bridgeport, Pa.
Chandler Co., Springfield, Mass.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Electro-Chemical Engraving Co., 52 Vanderbilt Ave., New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y.
Etching Co. of America, 1520 Montana, Chicago, Ill.
General Etching & Mfg. Co., 3070 W. Grand Ave., Chicago, Ill.
Grammes & Sons Inc., L. F., Allentown, Pa.
Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Waterbury Button Co., Waterbury, Conn.

NICKEL
American Mond Nickel Co., Century Bldg., Pittsburgh, Pa.
Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
Seymour Mfg. Co., Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.

NOTCHING MACHINES, Armature
Ferracute Machine Co., Bridgeton, N. J.

NUT SETTING MACHINES
Vim Electric Tool Co., 149 Broadway, New York, N. Y.

OHMMETERS. See Istruments, Laboratory Standard; also Instruments, Portable and Switchboard.

OIL-LESS BEARINGS. See Bearings, Oil-less.

OSCILLOSCOPES. See Instruments, Laboratory Standard.

OVENS, Industrial and Laboratory
Annealing, Temper Drawing, Mold Baking, Vulcanizing, Drying, Conditioning, Enameling, Japanning, Vacuum Impregnating.
Buffalo Fdry. & Machine Co., 1543 Fillmore, Buffalo, N. Y. (Armature and Coil.)
Crawford Oven Co., New Haven, Conn. (Coil Driers.)
Despatch Oven Co., 120 First Ave., N., Minneapolis, Minn.
Detroit Sheet Metal Wks., 1341 E. Milwaukee Ave., Detroit, Mich.
Devine Mfg. Co., J. P., Buffalo, N. Y.
Eberbach & Son Co., Ann Arbor, Mich. (Drying.)
Electric Heat Control Apparatus Co., 245 New Jersey R. R. Ave., Newark, N. J.
Emerson Apparatus Co., Melrose, Mass. (Conditioning.)
Freas Thermo Elec. Co., 1206 Grove, Irvington, N. J.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
General Electric Co., Schenectady, N. Y.
Hayes, C. I., 129 Baker, Providence, R. I.
Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 198 Piedmont, Waterbury, Conn.
Maehler Co., Paul, 2210 Lake, Chicago, Ill.
Miho Co., 717 Sycamore, Cincinnati, O.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Sargent & Co., E. H., Chicago, Ill.
Sioux Battery & Mfg. Co., Sioux City, Ia. (Battery.)
Snead & Co., Jersey City, N. J.
Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., H. E., 197 E. Kinney St., Newark, N. J.
Stokes Machine Co., F. J., 5826 Tabor Rd., Philadelphia, Pa.
Swartwout Co., 18522 Euclid Ave., Cleveland, O.
Thelco. See Freas Thermo Elec. Co.
Vacuum Impregnating Wks., 626 Federal, Chicago, Ill. (Impregnating).
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Young Bros. Co., 6500 Mack, Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

PACKING
Cooke Seal Ring, Dept. J, 46 N. Green St., Chicago, Ill.
Federal Metallic Packing Co., Wakefield, Mass.
Packtite. See Federal Metallic Packing Co.

PAINT, Varnish, Lacquer
KEY
Varnishes, Insulating ..... See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof.. See P
Lacquer, Metal Finishing ..... See L

Acme White Lead & Color Wks., 8230 St. Aubin Ave., Detroit, Mich. L
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y. ..... V .. ..
American Lastite Co., 3166 Lincoln Ave., Chicago.. .. P L
Antakwa Co., 1339 Mohawk, Chicago, Ill. .... P ..
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. L
Armlac. See Roberison Chemical Co.
Arolac. See Arizona Lacquer Mfg. Co.
Art-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Colt, Irvington, N. J. L
Atom Chemical Co., 96 E. 10th, New York, N. Y. L
Bakelite Corp., 247 Park Ave., New York, N. Y. L
Benolite Varnish Co., Pittsburgh ..... V P ..
Berry Bros., Leib & Wight, Detroit, Mich. ..... V .. ..
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.. V .. ..
Biwax Corp., 208 S. La Salle, Chicago, Ill. .... P ..
Bradley-Hurtz Co., 2626 S. Dearborn, Chicago, Ill. L
Brevolite. See Waukegan Chemical Co.
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y. ..... V P ..
Carboloid Products Corp., 15 Park Row, New York, V P ..
Chinalac. See Dolph Co., John C.
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. ..... V P ..
Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzelns, Columbus, O. V .. ..
Comulac. See Martindale Elec. Co.
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P ..
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del.. .. P ..
Eastman Kodak Co., Rochester, N. Y. L
Eclipse Paint & Mfg. Co., Cleveland, O. .... P ..
E. B. See Mitchell-Rand Mfg. Co.
Egyptian Lacquer Mfg. Co., 90 West, New York.. L
Electric Lacquer. See Dolph Co., John C.
Enamelac. See Robertson Chemical Co.
Ever-Brite Products Co., East Liverpool, O. L

23

LACQUERS

Lacquer Enamels—"Krakles"

BREVOLITE

Quality finishes and helpful Service. What can we do for You?

Waukegan Chemical Co.
"Values That Endure"
North Chicago, Ill.

Federal Insulating Corp., Yonkers, N. Y. ..... V P ..
Franche & Co., 440 Orleans, Chicago, Ill. L
General Elec. Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. ..... V P ..
General Plastics, Inc., 116 Walck Rd., N. Tonawanda, N. Y. ..... V .. ..
George Co., P. D., St. Louis, Mo. ..... V .. ..
G. E. See General Elec. Co.
Glidden Co., Cleveland, O. ..... V P L
H. B. See Maas & Waldstein Co.
Hilo Varnish Corp., Marcy & Flushing Aves., Brooklyn, N. Y. ..... V P L
Impervious Varnish Corp., 421 Wood, Pittsburgh. V P ..
Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. .... P L
Laqueroid. See Glidden Co.
Liberty. See Antakwa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. Co., 450 E. 3rd, Dayton, O. ..... V P ..
Lucas & Co., John, 322 Race, Philadelphia, Pa.. V P ..
Lucote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. ..... V P ..
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. ..... V .. ..
Mawalac. See Maas & Waldstein.
Mecco. See Henry V. Walker Co.
Mica Insulator Co., 200 Varick St., New York.... V .. ..
Mi I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P ..
Nepto Lac. See Lowe Bros. Co.
Nikolas & Co., G. J., 1227 W. Van Buren, Chicago. L
O'Brien Varnish Co., South Bend, Ind. ..... V P L
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. .... P ..
Opex. See Sherwin-Williams Co.
Ozite. See Standard Underground Cable Co.
P. & B. See Ruberoid Co.
Pacoria Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Pedigree. See George Co., P. D.
Peninsular Paint & Varnish Co., Detroit, Mich. L
Peerless. See Maas & Waldstein Co.
Proxlin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. .. P L
Reliable Leather Dressing Co., 43 Crescent, Long Island City, N. Y. ..... V .. ..
Republic Varnish Co., 200 Thomas, Newark, N. J. V .. ..
Robertson Chemical Co., 9805 Meech Ave., Cleveland, O. ..... V P ..
Rockbestine. See Rockbestos Products Corp.
Rockbestos Products Corp., New Haven, Conn. .... V .. ..
S. P. C. See Ruberoid Co.
Schenectady Varnish Co., Schenectady, N. Y. ..... V P ..
Sherwin-Williams Co., Cleveland, O. ..... V P L
Sipe & Co., James B., Chamber of Commerce Bldg., Pittsburgh, Pa. L
Southwestern Paint & Varnish Co., 610 Broadway, Kansas City, Mo ..... V P ..
Standard Flexible Comp. Co., Franklin Trust Bldg., Philadelphia, Pa. ..... V P ..
Standard Insulation Co., Rutherford, N. J. ..... V .. ..
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa. .... P ..
Standard Varnish Wks., 443 4th Ave., New York. V P L
Sterling Varnish Co., Haysville, Pa. .... P ..
Toch Bros., 443 4th Ave., New York ..... V P L
Truscon Laboratories, Canift & Grand Trunk Railway, Detroit, Mich. ..... V .. ..
3098. See Mitchell-Rand Mfg. Co.
Varflex Corp., Rome, N. Y. ..... V .. ..
Voltax Co., 99 Reservoir Ave., Bridgeport, Conn. V P ..
Vulcan-Lastite. See American Lastite Co.
Walker Co., Henry V., 17 John St., New York. L
Walpole. See Robertson Chemical Co.
Waukegan Chemical Co., North Chicago, Ill. L
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa. V P ..
Zapon Co., Stamford, Conn. L
Zellac. See Zeller Lacquer Mfg. Co.
Zeller Lacquer Mfg. Co., 20 E. 49th, New York. L

PANELS (panel) Engraving. See Engraving.
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Radio (Hard Rubber) See Rubber Hard.
Meters. See Instruments, Portable & Switchboard

PAPER
Boxes. See Boxes & Wrappers.
Bushings. See Tubes, Paper.
Candles. See Candles, Fixture.
Cores. See Tubes, Paper.

24

Dolph's

CHINALAK—A baking insulating varnish that *thoroughly dries* Thor-wound coils, dry from the *inside-out*—not merely surface drying Write for samples.

ELECTRIC LACQUER—Absolutel oil proof and water repellent Can be brushed, sprayed or dipped. Gives a bright, gloss non-fading black finish and dries in 30 minutes

JOHN C. DOLPH CO., 168 Emmett St., Newark, N. J

The Chandler Co

Name Plates

Springfield Mass.

Patents and Trade Marks!

Protect your most valuable assets. Superior service. Prompt attention.

LESTER L. SARGENT

Registered Patent Attorney

1115-K St., Washington, D. C.

OHIO reliable MOTORS

Checking over a list of Ohio Motor Users is another way of indicating Ohio Motor Quality. After all, the service any Motor driven device will render is no better than that of the Motor itself.

Double Wick Sleeve Bearings or Ball Bearings.

1/20 to 1/3 Horse Power—Horizontal or Vertical.

The Ohio Electric & Controller Company
5905 Maurice Avenue Cleveland, Ohio

If you are a manufacturer

of a motor-driven device that requires heavy torque or a quick start under load, we can show you a line of motors that cost little, if any, more than commercial sizes. Fifteen thousand Zobells in heavy duty service, on cranes, hoists and printing presses for years. A quality product, custom built to meet your needs at moderate prices in quantity lots to manufacturers.

Let us send you information that may save thousands of dollars and improve the service of your motor-driven equipment.

ZOBELL
HIGH TORQUE MOTORS

ZOBELL ELECTRIC MOTOR CORPORATION
GARWOOD, NEW JERSEY.

3005

1929

THIS optimistic young man will write Chapter No. 7 of Leland history. If he does as fine a job as the old gentleman who just left us, we shall have no regrets.

He should, however, write a far more interesting story because we are prepared to build a still finer motor and more of them.

Let us hope this same new scribe writes an interesting chapter for you also — that he chronicles the very best year in all your history.

Accept, gentlemen, our very best wishes, and believe us cordially yours,

The Leland Electric Company
Dayton, Ohio
U. S. A.

Leland
fractional horsepower
Motors

PAPER—Continued
Fibre. See Cloth and Paper.
Fish. See Cloth & Paper.
Insulating. See Cloth and Paper.
Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
Sleeves. See Tubes, Paper.

PARAFFINE. See Wax and Compounds.

PATENT ATTORNEYS

Sargent, Lester L., 1115 K Street, Washington, D. C.

PARCHMENT PAPER, Lamp Shade

Angel H. Reeve & Co., 7 Spruce, New York, N. Y.
Bergstrom Paper Co., Neenah, Wis.
Bradley Mfg. Co., A. J., 101 Beekman, New York, N. Y.
Brown Paper Co., L. L., Adams, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.
New York & Penn Co., 200 5th Ave., New York, N. Y.
Paterson Parchment Paper Co., Passaic, N. J.
Raquette River Paper Co., Potsdam, N. Y.
Reeve & Co., Angel H., 7 Spruce, New York, N. Y.
Rogers Paper Mfg. Co., So. Manchester, Conn.
Special Paper Mfg. Co., 96 Reade, New York, N. Y.
Strype, Fred C., 140 Lafayette, New York, N. Y.
Taylor-Logan Co., Holyoke, Mass.
Union Paper & Twine Co., 116 St. Clair Ave., N. W., Cleveland, O.
Warren Parchment Co., Dexter, N. Y.
Weber Co., F., 1220 Buttonwood, Philadelphia, Pa.
West Carrollton Parchment Co., West Carrollton, O.
Windsor Locks Paper Mills Co., Windsor Locks, Conn.

PEGS, Armature

Campbell Fibre Co., Heather Ave., Stanton, Del.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Federal Insulating Corp., Yonkers, N. Y. (Also Wedges.)
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
White Supply Co., 4347 Duncan, St. Louis, Mo.

PENS, Scorching

Gilbert Supply Co., Independence, Iowa.
Little Speedster. See Gilbert Supply Co.
Post Elec. Co., 7 E. 44th, New York, N. Y.
Stylectric. See Post Electric Co.

PERFORATING MACHINES

American Perforator Co., 617 W. Jackson, Chicago, Ill.
Asam Bros., 917 Arch, Philadelphia, Pa.
Asam Wright. See Asam Bros.
Capital Novelty Co., Lincoln, Neb.
Cummings Co., B. F., 4710 Ravenswood Park, Chicago, Ill.
Hamilton Engrs. Products Co., Hamilton, Ohio (Music Rolls).

PHENOLIC INSULATION. See Fibre, Phenol. Also Molded Insulation.

PHOSPHOR BRONZE

(Ingot, Rod, Sheet, Wire)
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Elephant Brand. See Phosphor-Bronze Smelting Co.
Gilby Wire Co., Riverside Ave., Newark, N. J.
Phosphor-Bronze Smelting Co., 2200 Washington Ave., Philadelphia, Pa.
Scovil Mfg. Co., Waterbury, Conn.

PHOTO-ELECTRIC TUBES

Burt, R. C., 327 S. Michigan Ave., Pasadena, Cal.
Foto Cell. See Raytheon Mfg. Co.
General Electric Co., Schenectady, N. Y.
Kino-Lamp. See Raytheon Mfg. Co.
Photion Instrument Corp., 574 Southern Blvd., New York.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Raytheon Mfg. Co., Cambridge, Mass.
Westinghouse Elec. & Mfg. Co., Mansfield, Ohio.

PHOTOMETERS, Lamp Testing

Biddle, James G., 1211 Arch, Philadelphia, Pa.
Foote, Pierson & Co., 160 Duane, New York, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Holophane Co., 342 Madison Ave., New York, N. Y.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Luxometer. See James G. Biddle.
Mathews. See Foote, Pierson & Co.
National Lamp Wks. of G. E. Co., Cleveland, O.

PICK-UPS, TALKING MACHINE. See Loud Speakers.

PIGTAILS, Commutator. See Brushes, Commutator.
Wire Gauze. See Brushes, Commutator.
Vacuum Cleaner. See Brushes for Vacuum Cleaners.

PINIONS. See Gears and Pinions.

PINION PULLERS. See Pullers, Armature Shaft.

PLASTICS. See Molded Insulation.

PLATES, Name. See Name Plates; Also Decalcomanie.

PLATES,
Fixture Outlet. See Fixture Fittings.
Storage Battery. See Plates, Storage Battery.

PLATES, Storage Battery

Am-Plus Storage Battery Co., 425 W. Superior, Chicago.
Are Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Champion. See Englert Mfg. Co.
C. & B. Battery Co., 1535 S. State, Chicago, Ill.
Edes Mfg. Co., Plymouth, Mass.
Englert Mfg. Co., 2500 Jane, Pittsburgh, Pa.
Esto. See New Jersey Storage Battery Co.
Fort Wayne Battery Mfg. Co., 230 E. Fourth, Ft. Wayne.
Handler. See Witherbee Storage Battery Co.
Link & Hemrick, Inc., 555 W. 52nd St., New York, N. Y.
New Jersey Storage Battery Co., 656 Summit Ave., Union City, N. J.
Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
Witherbee Storage Battery Co., 75 Columbus Ave., New York.

PLATING GENERATORS

American Giant. See Connecticut Dynamo Motor Co.
Bogue Elec. Co., Chas. J., 132 King, New York, N. Y.
Burke Elec. Co., Erie, Pa.
Chandeysson Elec. Co., St. Louis, Mo.
Connecticut Dynamox Motor Co., Irvington, N. J.
Conpro. See Eager Elec. Co.
Eager Electric Co., 522 Novell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Speciality Co.
Fidelity Elec. Co., Lancaster, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hobart Bros. Co., Troy, O.
Holtzer-Cabot Elec. Co., 125 Amory, Boston, Mass.
Ideal Electric & Mfg. Co., East Third St., Mansfield, O.
Jantz & Nelst Elec. Co., Cincinnati, O.
Kendrick & Davis Co., Lebanon, N. H.

CONTACT POINTS
Must Not Fail

CONTACT points, of all things, must be absolutely reliable—so much depends upon their proper functioning. Long experience and extra care in manufacturing have made Baker Contact Points the safe, reliable units they are. They may be had of Platinum, Iridio-Platinum, Silver and special alloys. We shall be glad to send you detailed descriptions.

BAKER & CO., INC.
54 Austin St. Newark, N. J.

L'Hommedieu & Sons Co., Chas. F., 4521 Ogden Ave., Chicago, Ill.
Optimus. See Hanson-Van Winkle & Munning Co.
Reliance. See L'Hommedieu & Sons Co., Chas. F.
Roth Bros. & Co., Chicago, Ill.
Westinghouse Elec. Mfg. Co., East Pittsburgh, Pa.

PLATING AND FINISHING

Chromium Plating, Rust Proofing and other special metal-finishing processes.
Amaloy. See American Machine & Foundry Co.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Atlantic Chemical Co., Colt, Irvington, N. J.
Duro Chrome. See General Chromium Corp.
General Chromium Corp., 3220 Bellevue Ave., Detroit, Mich. (Chromium Plate.)
Parker Rust-Proof Co., 2177 E. Milwaukee, Detroit, Mich.
Rochester Elec. Products Corp., 89 Allen, Rochester, N. Y.
United Chromium, 30 E. 42nd, New York, N. Y.
Udylite Process Co., 3220 Bellevue Ave., Detroit, Mich. (Rust-Proof Finish.)

PLATINUM,

Sheet, Rod, Tubing, Wire.
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J.
A. & H. Platinum Works, 709 Sixth Ave., New York.
Wilco. See H. A. Wilson Co.
Wildberg Bros., Smelting & Refining Co., 742 Market, San Francisco, Cal.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

PLUG FUSES. See Fuses and Fuse Wire.

PLUG RECEPTACLES. See Receptacles, Plug.

PLUGS, Flashing. See Flashers, Sign.

PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment

A-1 Bakelite. See Connecticut Elec. Mfg. Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alcor Mfg. Co., 4605 W. Madison, Chicago.
Amelite Elec. Mfg. Co., New Haven, Conn.
Anylite Elec. Co., Fort Wayne, Ind.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Arro-Grip. See Arrow Elec.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beaver Mfg. Co., 425 N. Third, Newark, N. J.
Bee-Ell Elec. Mfg. Co., 79 Mercer, New York, N. Y.
Belden Mfg. Co., 2310 B. S. Western Ave., Chicago, Ill. (Special Soft Rubber Plug Furnished with Belden Cords).
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Elec. Co., Bridgeport.
C. H. See Cutler-Hammer Mfg. Co.
Carling Tool & Machine Co., 33 Union Place, Hartford, Conn.
Cemco. See Connecticut Elec. Mfg. Co.
Cetelite. See Connecticut Moulded Products.
Circle F Mfg. Co., Trenton, N. J.
Colts Patent Fire Arms Mfg. Co., Hartford, Conn.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Moulded Products Corp., Meriden, Conn.
Cutler-Hammer Mfg. Co., 1388 St. Paul Ave., Milwaukee.
Diamond, H. See Hart Mfg. Co.
Dreadnaught. See Cutler-Hammer Mfg. Co.
Eagle Elec. Mfg. Co., Dept. ER4, 50 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3257 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
Fitzall. See Rodale Mfg. Co.
Gaynor Elec. Co., Inc., Stratford Ave., Bridgeport, Conn.
GE-Flex. See General Electric Co.
General Electric Co., Section W-231, Bridgeport, Conn. (Special Soft Rubber Plug furnished with G. E. Cords.)
Globe Metal Mfg. Co., 2122 E. Hazzard, Philadelphia, Pa.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Gripall. See Beaver Mfg. Co.
Handle Cap. See Beaver Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Heetach. See Marks Products Co.
Hemco. See Bryant Electric Co.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Iona Co., Los Angeles, Cal.
Iiffy. See Esler Elec. Mfg. Co.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Marks Products Co., 23 E. 16th, New York.
Metropolitan Electric Mfg. Co., Blvd. at 14th St., Long Island City, N. Y.
Nelco. See Nelson Elec. Co.
Nelson Elec. Co., Plant City, Fla.
P. & S. See Pass & Seymour.
Paragon Elec. Sales Co., 215 S. Fifth, Philadelphia, Pa.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Propp Co., M., 524 Broadway, New York.
Quick Catch. See Hubbell, Inc., Harvey.
Real. See Smith & Co., T. C.
Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Romeo. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 1015 Chestnut, Philadelphia.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 80 Boylston, Boston 11, Mass.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 30 Church, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Suitzall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
Tedco. See Paragon Elec. Sales Co.
Telltale Tap. See General Elec. Co.
Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
Un-X-Ld. See Speedway Elec'l Mfg. Co.
Utilo Mfg. Co., 330 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

POINTS, Contact

American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Independent Contact Mfg. Co., 545 39th, Union City, N. J. (Tungsten.)
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
King Mfg. Corp., Rano & Crowley Sts., Buffalo, N. Y. (Platinum.)
National Contact Co., 33 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
R. & H. Platinum Works, 709 Sixth Ave., New York.
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.

POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN

Bushings. See Bushings, Box & Cabinet.
Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes

Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metsch Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard Porcelain Co., Leetonia, O.
Standard & Specialty Porcelain Co., Sun Prairie, Wis.
Star Porcelain Co., Muirhead St., Trenton, N. J.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.
Woolley, Inc., W. Douglas, East Liverpool, O.

POROUS CUPS

Unglazed earthenware cups for primary (wet) batteries
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding

Binding Posts, Switch Parts, Stop Points, Contacts, Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York.
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.

Hardy Metal Contact Points

Give Service Equal or Superior to Platinum

Its unusually high resistance to oxidation makes Hardy Metal especially adaptable for heavy service, where arcing burns the life out of ordinary points.

HARDY METAL CORPORATION,
P. O. Box 2037, Seattle, Wash.

Everything in
PORCELAIN
Wet, Dry, Cast and Jiggered Processes
W. DOUGLAS WOOLLEY, INC.
East Liverpool, Ohio

PORCELAIN
Mercer Porcelain Co., Inc., Trenton, N. J.
SPECIAL SHAPES
Let Us Quote Prices

No. 44

Universal Motor for 110 Volts

Suitable for phonograph drives, drink mixers, sewing machines, small Lathes, etc.

Battery motors and small generators our specialty. Send for circular.

LIBERAL DISCOUNTS TO DEALERS.

KENDRICK & DAVIS CO.
LEBANON, NEW HAMPSHIRE

B-Line Motors *must* make good—or we will

Made in A. C. Repulsion Induction and Squirrel Cage types; Single phase, polyphase and D. C. types.

Sizes ¼ to 3 H. P.

We have not skimped in either quality of material or design in building B-Line Motors. We began to build motors so good that they *had* to bring repeat orders; we've kept at it, and backed up B-Line quality with an unbreakable guarantee.

THE BROWN-BROCKMEYER CO., Inc.
DAYTON, OHIO *Sales offices in principal cities.*

★NATIONAL★

RHEOSTATS

UNEQUALED: BUT COST NO MORE

Adjustable Resistance At Its Best

SMALL IN SIZE
LIGHT IN WEIGHT
HIGH IN QUALITY
LOW IN PRICE
LONG IN LIFE

FINE CONTROL

MOTOR SPEED CONTROLLERS
LABORATORY RHEOSTATS
HEAT REGULATORS
FIELD RHEOSTATS
DIMMERS, ETC.
RADIO RHEOSTATS

Our 20th Year—Ask for Catalog

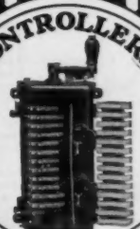
National Electric Controller Company
5315 Ravenswood Ave., Chicago, Ill., U. S. A.

UNION DRUM

Electric Motor Control Apparatus

ALL TYPES OF D.C. MOTORS

CONTROLLERS

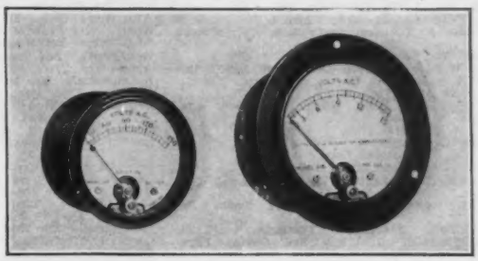


SLIP RING SQUIRREL CAGE MULTI-SPEED A.C. MOTORS

Union Electric Mfg. Co.
Milwaukee, Wis.
Offices in all Principal Cities

Standard-Special Explosion Proof For all Purposes A.C.-D.C.

CRANES HOISTS TRUCKS TRACTORS METAL AND WOOD MACHINERY OIL FIELD AND REFINERY APPLICATIONS



Weston Panel Instruments

The 2" and 3¼" diameter flush type panel instruments shown in the illustration have gained wide popularity in many fields of electrical testing. They are designed for use where close control of small electrical equipment is required —as in direct motor drive, electric welding, heat treating, communication engineering, radio manufacturing, broadcasting and receiving, and countless other applications.

Small, compact, and possessing exceptional electrical characteristics for instruments of this size, the electrical engineer will find these miniature panel models fully as satisfactory for a great variety of small testing requirements as larger and more expensive instruments.

They are beautifully and precisely constructed, inimitable in design, workmanship, and performance. Yet, they are moderately priced. When considering the purchase of small panel instruments it will pay you to compare the following characteristics of Weston designs with other makes which the market affords.

2" and 3¼" A. C. Panel Instruments which form a part of the Complete Matched Lines of A. C., D. C., and Thermo-Couple Types.

1 —**Accuracy,** guaranteed at 2%. Open scales give readings down to 1/10 of full scale value.
2 —**Unusual sensitivity**—viz.: 150 volt range takes only 9½ M. A. at full scale deflection.
3 —**Low resistance of Ammeters**—viz.: the 5 ampere range has a total resistance of only 1/100 of an ohm.
4 —Ammeters will withstand **greater overloads** than those for which current transformers are usually designed.
5 —Designed for **continuous operation,** with **negligible heating,** on any commercial frequency.
6 —Voltmeters are **self-contained** as high as 300 volts; ammeters, as high as 50 amps.; and milliammeters, as low as 15 M. A.
7 —Excellent **damping.**
8 —Fog-proof and dust-proof.
9 —Interchangeability of parts.
10—Drawn steel outer case and two-piece moulded bakelite body afford **complete protection** to internal parts, as well as **magnetic shielding** from stray fields.

WESTON ELECTRICAL INSTRUMENT CORP.
582 Frelinghuysen Ave. Newark, N. J.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

POSTS, Binding—Continued
Eby Mfg. Co., Inc., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip.)
Nutmeg. See Hart & Hegeman Co.
Polk, J. L., 41 Bell Ave., Troy, N. Y.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.

POTENTIOMETERS (Radio Control). See Radio Receiver Parts.

POWDERED CARBON. See Carbon, Powdered.

POWER TRANSMISSION CHAIN. See Chain, Power Transmission.

PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil

Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation

Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Elmes Engrg. Works, Chas. F., 332 N. Morgan, Chicago, Ill.
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill.
Farquhar Co., A. B., York, Pa.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5826 Tabor Rd., Olney, Phila delphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y.
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding

Baird, Andrew, 2715 Newark, Detroit, Mich.

PRESSES, Punching

Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y.
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Loshbough-Jordan Tool & Machine Co., Elkhart, Ind.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier.

PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft

Motor Pulley, Shaft & Pinion Pullers & Extractors.
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4852 Roosevelt Rd., Chicago, Ill.

PULLEYS, Composition

General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner

Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

PUMPS, Vacuum

To Exhaust Incandescent Lamps.
Arrow Machine Co., 527 Hackensack Plank Rd., Union City, N. J.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Eimer & Amend, 205 3rd Ave., New York, N. Y.
Elsler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.

PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel

(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1820 Chouteau Ave., St. Louis, Mo. (Tensionless Doreeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS

This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Air-King Products Co., 222 Grand, New York, N. Y. (Kit.)
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn, B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bonine. See Turn-it Radio Sales.
Branson Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J.
Columbia Metal Products Co., 360 E. Grand Ave., Chicago,
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Crosradio Corp., 166-33 Jamaica Ave., Jamaica, N. Y.
Crafd. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 900 W. Jackson Blvd., Chicago.
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hammarlund-Roberts, 1182 Broadway, New York. (Kit.)
Hardwick Field, Inc., 215 Emmet, Newark, N. J.
Harmonik. See Karas Elec. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 260 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Inverarad, Tenleak. See Pilot Elec. Mfg. Co.
J-M-P. Mfg. Co., 3320 Fond du Lac Ave., Milwaukee, Wis.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Kelford. See American Specialty Co.
Kenyon Transformer Co., 122 Cypress Ave., New York, N. Y.
Kilograd. See Pilot Elec. Mfg. Co.
Krobiack. See Mountford, C. E.
Kunrox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn
Lavite. See Aerovox Wireles Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J (Radio Resistance).
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lauts Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metralign. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y. (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutro-Grad. See Pilot Elec. Mfg. Co.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Perry Wire Works, 280 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Plander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Elec. Mfg. Co.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Protectorald. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent), Hatheway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Sangamo Elec. Companies, Springfield, Ill.
Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill. (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Submariner. See J-M-P Mfg. Co.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Syncrodenser. See Precise Mfg. Corp.
Tandem. See Bremer-Tully Mfg. Co.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago.
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Torostyle. See Bremer-Tully Mfg. Co.
Transcript-Clapp Kit. See Samson Electric Co.
Trutonic Amplification. See Alden Mfg. Co.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill.
Ultra Vario. See Bruno Radio Corp.
Universler Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York.
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.

RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS

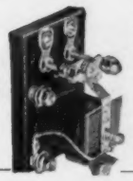
Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York
Bonine. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co., Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

"DUNCO" Products

J S D

Relay Switches

Style 405



Used to transfer line current from one load to another, or to transfer load automatically from one source of power to another.

We are specialists in building relays to suit every requirement. May we build you a sample? *Write for catalog* R-2.

Fish Spine Beads

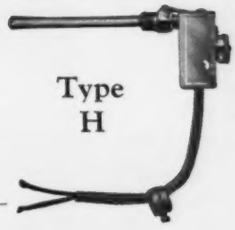
The best bare wire insulation for high heat uses, withstanding 3000° F. without change. Porcelain insulators with ball and socket joint, so that bend does not expose the wire. Samples on request.

Immersion Thermostat

For control of temperature of water, wax, oil, and metal. Temperature range up to 600° F.—accuracy up to 1%.

Supplied for 2 and 3 wire control—adjustable and non-adjustable.

Please let us know your requirements.



Type H

STRUTHERS DUNN, Inc.
1133 Race St., Philadelphia, Pa.

NEW CODE

SORGEL AIR COOLED

TRANSFORMERS

WITH CONDUIT CONNECTIONS

According to the New 1928 National Code balance coils are not permitted to supply lighting or appliance circuits.

Sorgel Air Cooled Transformers

Meet All Requirements of the Code.

Send for Descriptive Literature

MADE IN SIZES ¼ TO 50 K. V. A. INCLUSIVE SINGLE PHASE TWO PHASE and THREE PHASE.

Transformers designed for special applications.

SORGEL ELECTRIC COMPANY
89 W. Water Street Milwaukee, Wis.

Over 200,000 Revolving Proofs!

Nearly a quarter million Cooke Seal Rings have been sold to date—with universal satisfaction. For this simple mechanical device, which seals any rotating shaft in the stuffing box and revolves *with it*, eliminates packing, leaks, expense, trouble, hot boxes, oil waste and 90% of the friction. Absolutely seals any gas, liquid or vapor at any pressure. For pumps, compressors, motors—a thousand places where it can or is now being successfully used.

Machinery Makers:

Ask us to show you how Cooke Seal Rings can improve the efficiency of your product.

Machinery Users:

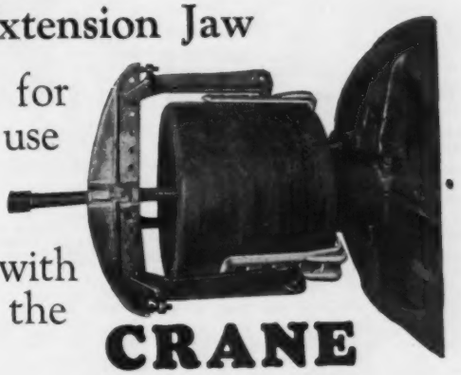
Your local supply house will sell you Cooke Seal Rings to install in your present stuffing boxes. Or write us direct.

COOKE SEAL RING

Dept. J

46 North Green Street, Chicago, Illinois

New Extension Jaw for use with the



CRANE PULLER

Write for illustrated catalog and price list

For *easy removal of wide faced pulleys*, etc., especially paper faced pulleys, without injury. The view shown above is of a three arm Crane Puller with a set of these jaws removing a 24" x 26" paper faced pulley from a 200 H.P. motor. Crane Pullers are made in four sizes and two styles to take care of any kind of work from 6" to 24" in diameter, such as the removal of pulleys, gears, sprockets, collars, etc.

CRANE PULLER COMPANY
Waltham, Mass.

RADIO PANEL ENGRAVING. See Engraving, Radio Panel

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.

Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelug. See Jones, Howard B.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ro-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 172 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Heinemann Elec. Co., Philadelphia, Pa.
Imp. See Carter Radio Co.
Jones, Howard B., 2226 Wabansia, Chicago, (Multiple Plug.)
Klosner Radio Corp., 1022 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th & Greenwood Ave., Chicago.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Premier Elec. Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Reeto Mfg. Co., 23 W. Third, Cincinnati, Ohio
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Royalty. See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio
Tubestat. See Muter Co.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Elec. & Mfg. Co., 351 Halsey, Newark, N. J.
Cable Supply Co., 31 Union Square, New York, N. Y.
Ceco Mfg. Co., 702 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 406 Jefferson, Hoboken, N. J.
Cunningham, Inc., E. T., 370 Seventh Ave., New York, N. Y.
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Gold Seal Electrical Co., 250 Park Ave., New York, N. Y.
Manhattan Elect. Supply Co., 17 Park Pl., New York, N. Y.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Paramount Mfg. Co., 79 Orange, Newark, N. J.
Perryman Electric Co., 33 W. 60th, New York, N. Y.
Radio Corp. of America, 233 Broadway, New York.
Raytheon Mfg. Co., Kendall Square Bldg., Cambridge, Mass.
Sonatron Tube Co., 108 W. Lake, Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 588 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington, N. J.

RADIO TRANSFORMERS. See Radio Circuit Components

RADIO TUBE BASE BRANDERS. See Engraving Radio Panel.

RADIO TUBE BASES. See Radio Molded Parts.

RADIO TUBE BULBS (Unfinished). See Bulbs, Glass.

RADIO WIRING HARNESS

Special wiring cable and harness assemblies for radio battery connections, radio tube adapter harness for converting battery operated receivers to A.C. operation; Socket Adapters for Power Tubes; Loud Speaker Extension Cords—This heading also includes auto ignition assemblies.

Afco. See American Fabric Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alden Mfg. Co., Brockton, Mass. (Adapters.)
Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Adapters.)
Connectoralds. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corvaico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Morse Co., Frank W., Boston, Mass.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Onwaupun St., White Plains, N. Y.

RADIUM POWDER AND PAINT

Radium Dial Co., 3332 Forbes, Pittsburgh, Pa.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.

RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.

RAWHIDE GEARS. See Gears & Pinions, Rawhide.

READING LAMP BASES. See Bases, Reading Lamp.

REAMERS, Pipe. See Stocks, Dies and Reamers.

RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

	KEY
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Anderson Mfg. Co.							
Adam Electric Co., Frank, St. Louis, Mo.	F						
Adapti Co., 2996 E. 72nd, Cleveland, O.	F						
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.		B	W	M	C	E	
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.				M			
Arktite. See Crouse-Hinds Co.							
Arnessen Electric Co., 13 Water, New York				M			
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.	F	B	W				
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y.						E	
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.	F		W	M			
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.)			W				
Campbell. See Steel City Elec. Co.							
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal.	F						
C. E. M. Co. See Conn. Elec. Mfg. Co.							
C. H. See Cutler-Hammer Mfg. Co.							
Circle F Mfg. Co., Trenton, N. J.				M			
Conduletto. See Crouse-Hinds Co.							
Connecticut Elec. Mfg. Co., Bridgeport, Conn.	F						
Cory & Son, Chas., 183 Varick, New York				M			
Crouse-Hinds Co., Syracuse N. Y.		B	W				
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis.	F						
Delta-Star Elec. Co., 2433 Fulton, Chicago			W	M			
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.						C	
Elwell Parker Elec. Co., 4222 St. Clair Ave., N. E., Cleveland, O.		B					
Fielding. See Stanley & Patterson.							
Fountain's. See Jenkins Mfg. Co.							
Fullman Mfg. Co., Latrobe, Pa.	F						
Fullman. See Steel City Elec. Co.							
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn.		B					
Gleason & Co., J. L., 241 Franklin, Boston, Mass.						E	
H. & H. See Hart & Hegeman Mfg. Co.							
Hart & Hegeman Mfg. Co., Hartford, Conn.		B	W				
Hessel Co., W. F., 76 Greenwich, New York, N. Y.			W	M		E	
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.)		B	W				
Indestructible. See Kliegl Bros. Universal.							
Jenkins Mfg. Co., Bloomfield, N. J.						E	
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.	F	B	W	M			
Latrobe. See Fullman Mfg. Co.							
Loeffelholz & Co., Milwaukee, Wis.						C	
Major Equipment Co., 4603 Fullerton Ave., Chicago, Ill.				M			
NePage McKenny Co., Armour Bldg., Seattle, Wash.	F						
Novelty Elec. Co., Tench & Cherry Sts., Philadelphia, Pa.						G	
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio.			W				
Ostrander Elecl. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.							
Preset. See Walker Bros. Co.							
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.			W	M	C	E	
Quadrangle Mfg. Co., 30 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)							
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.							
Russell & Stoll Co., 53 Rose, New York	F	B	W	M		E	
Square D. Co., Detroit, Mich.			W				
Stanley & Patterson, 150 Varick, New York, N. Y.	F						
Steel City Elec. Co., Pittsburgh, Pa.	F					E	
Thomas & Betts Co., 15 Park Place, New York, N. Y.	F						
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.				M			
Walker Bros., 1417 Sansom, Philadelphia	F					E	
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.		F	B	W	M		
Yale. See Electric Products Co.							

RECORDERS, Elapsed Time. See Indicators, Operation.

REDUCERS, Socket. See Socket Reducers.

REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

4-Bolite Reflector Co., 7500 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Maxolite. See Raleo Mfg. Co.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Oamed. See Overbaugh & Ayers.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.

REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
Allen Filter Co., 25 S. St. Clair, Toledo, O. (Water Cooler Unit.)
American Refrigerator Corn., Peru, Ind.
Argus Products Co., 174 E. Water, Portland, Ore.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Automatic. See Illinois Refrigerator Co.

Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectriCE Corp., Belding, Mich.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Castle Double-Servis. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 131 E. 34th, New York, N. Y.
Cold Storage Refrigerator Co., Eau Claire, Wis.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dillingham Mfg. Co., Sheboygan, Wis.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 356 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Cabinets, Inc., 6504 Euclid Ave., Cleveland, O.
Hill & Co., C. V., 360 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich
Howe Scale Co., Rutland, Vt.
Iceless Cooler Corp., 225 N. Michigan Ave., Chicago, Ill. (Ice Cream Cabinets.)
Illinois Refrigerator Co., Morrison, Ill.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Ligonier Refrigerator Co., Ligonier, Ind.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2864 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymetl. See Haskelite Mfg. Co.
Ranney Refrigerator Co., Greenville, Mich.
Reol. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Revolvo. See Iceless Cooler Corp.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5781 Commonwealth Ave., Detroit, Mich.

RELAYS

(See also Circuit Breakers and Thermostats.)

Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1133 Race, Philadelphia, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.

REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Lautz Mfg. Co., 245 N. J. R.R. Ave., Newark, N. J.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.

RESISTORS. See Units, Rods & Grids.

REVOLUTION COUNTERS. See Tachometers.

RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

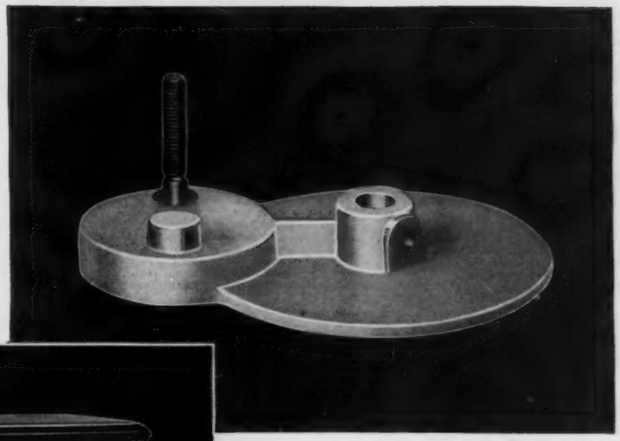
RHEOSTATS

	KEY
Battery Charging	See B
Stage Dimming	See D
Meter Testing (Laboratory)	See L
Plating Tank	See P
Motion Pictures (Projector Lamp)	See M
Motor Starting, Field and Speed Regulating	See F

	F	B	D	P	M	L
Allen-Bradley Co., 493 Clinton, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill.				P		
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa.	F					

7 OPERATIONS ELIMINATED By Die Casting

<<<<<< and costs greatly reduced >>>>>>>



May we send you this illustrated, non-technical treatise on die casting — its possibilities and limitations? A request on your business stationery brings it to you.

A MILWAUKEE Die Casting containing a cast-in cadmium plated steel insert has replaced a cast iron counter-weight in the new Balkite radio receivers made by Fansteel Products Co., Inc.

As a result two drilling, one boring, one reaming, one riveting, and one tapping operation are eliminated as is the finishing operation formerly required to prevent rusting. (The die-cast alloy is rust proof.)

Incidentally, the accurate, uniform weight resulting from die casting in this particular case eliminates the necessity of balancing this part when the receiver is assembled.

Worthy of special mention is the fact that though the steel insert is cadmium plated before the casting is made, the die casting process does not injure the cadmium finish in any way.

Perhaps parts of your product can be re-designed for die casting with similar savings and advantages. Milwaukee die casting technicians can help you decide—without cost or obligation.

MILWAUKEE DIE CASTING CO., 289 Fourth St., Milwaukee, Wisconsin

MILWAUKEE
DIE CASTINGS AND BEARINGS

Screw Machine Products

UP TO 2¼ in. DIAMETER

OLSON MFG. CO.

56 Commerical St.

WORCESTER, MASS.

RHEOSTATS—Continued
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O. ..... F
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. ..... B
General Electric Co., Schenectady, N. Y. F L
Hanson-Van Winkle-Munning Co., Matawan, N. J. ..... P
Holzmuller, C. J., 1108 Howard, San Francisco, Cal. ..... D
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. ..... D .. M
Knoeller Elec. Co., De Pere, Wis. ..... F
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago. ..... F B D .. M L
Optimus. See Hanson-Van Winkle-Munning Co.
Robertson, Leo F., 536 W. 22nd, New York, N. Y. ..... M
Schaefer Bros. Co., 1059 W. 11th, Chicago .. B
Simplicity. See Cutler-Hammer Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.. F
Universal. See Ward Leonard Elec. Co.
Vitrohm. See Ward Leonard Elec. Co.
Ward Leonard Elec. Co., Mt. Vernon, N. Y. ..... F .. D .. M
Watton. See Electric Products Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. ..... F ..... M
RINGS Seal. See Packing.

RIVETS

Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.
RODS, Resistance. See Units, Rods and Grids.
ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Murhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
U. S. Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS

Goodrich Rubber Co., B. F., Akron, O.
Republic Rubber Co., Youngstown, O.
RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge

Sponge Rubber Co., Ashland, O.
RUBBER TAPE. See Tape, Rubber and Friction.
RUBBER TUBING. See Tubing, Rubber.
RUST PROOFING. See Plating & Finishing.
SAL AMMONIAC. See Chemicals, Battery.
SALTS, Battery. See Chemicals, Battery.
SATURATING TANKS. See Wire Manufacturing Machines
SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW DRIVING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

SCREW MACHINE PRODUCTS

Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
Barnes Co., Wallace, Bristol, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Cetoron Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 621 N. Noble, Indianapolis,
Linden & Co., 891 Broad, Providence, R. I.

Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)

Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive

Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine

Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston,
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)

American Screw Co., Providence, R. I.
SECOHMMETERS. See Instruments, Laboratory Standard.
SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery

Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES

Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Molded. See Molded Insulation.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric

Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 20th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 87 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Fosilite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chintz.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)

SCREW MACHINE PRODUCTS AND SPRINGS

for every purpose

WILLIAM STEINEN & COMPANY

297 Washington St. Newark, N. J.

PORTLAND-MONSON SLATE CO.

Quarriers of

Monson Slate

for Electrical Purposes, Natural Black, Oil Finish

Quarries: Monson, Maine

Office, Portland, Maine

Patent Lamp Shade Co., 1361 Franklin Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D. Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapeatrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES

Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 223 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Western Art Glass Shade Works, 101 Turk, San Francisco.
SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic

Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oamco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica

Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmilite. See Tar Heel Mica Co.
SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil

Munsell Company, W. P., 720 Frankfort, Cleveland, Ohio

SHEARS, Insulation

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket

Chase Brass & Copper Co., Waterbury, Conn.
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn. (Miniature.)
SHUNTS, Instruments. See Instruments, Laboratory Standard.
SIGN FLASHERS. See Flashers, Sign.
SIGN LETTER LENSES. See Lenses.

SILICA

Ottawa Silica Co., Ottawa, Ill. "Flint Shot."
SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire

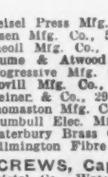
Baker & Co., Inc., 54 Austin, Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.
SILVER SOLDER. See Solder, Silver.
SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.
SKINNERS WIRE. See Scrapers.

Electrical SLATE

Large Stocks—Quick Deliveries. Send your Slate orders to us.

DAVIS SLATE & MFG. CO.

618 East 40th St., Chicago, Ill.



SCREW MACHINE PRODUCTS

In Brass or Steel

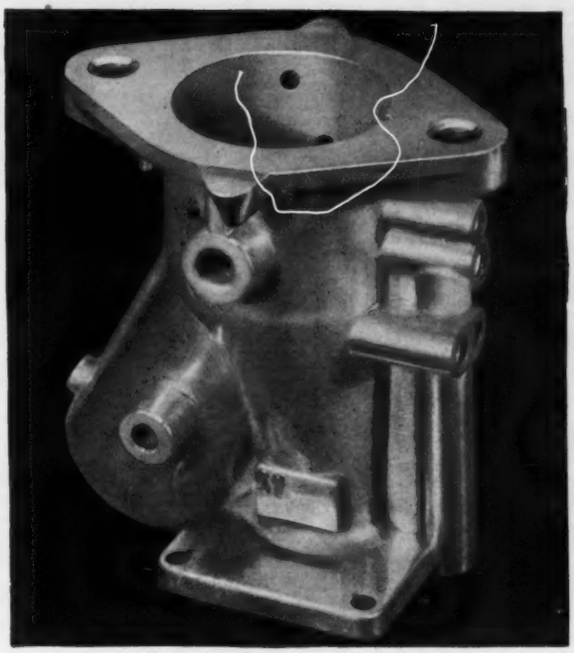
Send us your specifications for an estimate.

LINDEN & COMPANY

891 Broad St., Providence, R. I.

Fair Haven Marble & Marbleized Slate Co. **SLATE**

Fair Haven Vermont **GOODS**



Manufacturers facing the new year and the question "what more can we do to cut these costs?" may investigate the many advantages of Stewart Die Castings easily and quickly.

Authoritative and practical information on design and all the features of performance of Stewart Die Casting Service await your request to our engineering department.

DETROIT
CLEVELAND
DAYTON
ST. LOUIS
PITTSBURGH
NEWARK

The Stewart Die Casting Corporation
4500 Fullerton Avenue
Chicago, Illinois

E. M. 1-Gray

SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE
For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt.
Penrhyn Slate Co., Hydeville, Vt.
Portland-Munson Slate Co., Portland, Me.
Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.
SLEEVING, Cotton. See Tape, Cotton.
SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator
(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hulhorst Mitero Tool Co., 3240 E. Monroe, Toledo, O.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio.
Simplex. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

SNAP SWITCHES. See Switches, Snap

SOAPSTONE
For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Lin-Stun. See Westinghouse.
Soapstone Products Co., 97 Warren, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SOCKET LININGS. See Linings, Socket.
SOCKET SHELLS. See Shells, Screw Socket.
SOCKETS, Flashing. See Flashers, Sign.

SOCKET Chain and Attachments
Pull Chain, Chain Links, Chain Adjusters, Acorns, Extensions, Insulation Chain Splicers.
Abbott. See Harvey Hubbell, Inc.
American Brass Co., 25 Broadway, New York, N. Y. (Acorns.)
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Hart & Hegeman Mfg. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insr.

SOCKET REDUCERS
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 80 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp
Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key	See K
Composition	See W
Metal Shell	See B
Porcelain	See A
Pull Chain	See P
Push Through	See T
Sign Receptacles	See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo. ..... W
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. M C K T P B A
Arrogrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C .. .. P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. .... M .. K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. .....
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M .. K T .. B A
Crouse-Hinds Co., Syracuse, N. Y... A W .....

Cutler-Hammer Mfg. Co., 1287 St. Paul Ave., Milwaukee, Wis. ..... K T .. B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. .....
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... P B ..
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C .. ..
Federal Electric Co., 8700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C .. .. .. B ..
Gaynor Elec. Co., Bridgeport, Conn. ..... A
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn. ..... M C K T P B A
Glow Elec. Co., 22 Queens, Long Island City, N. Y. ..... M .. .. B A
Hart & Hegeman Mfg. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. .... W .....
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) .....
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 225 Newell, Brooklyn, N. Y. ..... M C K .. P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. .... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Meteor Elec. Corp., 499 E. 70th, New York, N. Y. ..... K .. P ....
Molded Socket Corp., Railroad, Pa. .... K .....
Multi Elec'l Mfg. Co., 210 N. Ogden Ave., Chicago, Ill. ..... A
Multiplok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. ..... M C K T P B A
Pauilding, John I., New Bedford, Mass. ..... B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. ..... A
Propp Co., M., 524 Broadway, New York, N. Y. .....
Quick Catch. See Hubbell, Inc.
Ratnee Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... M .. .. .. P B ..
Royal. See Sears, Henry D.
Safti Soc. See Molded Socket Corp.
Sears, Henry D., 80 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. .....
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. ..... A
TEC. See Electric Company.
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. ..... A
Union Insul. Co., Parkersburg, W. Va. .....
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. ..... P .. B .. W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. ..... A
Walco. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. .....
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B ..
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P ....
Wiring Devices, Inc., 5 High, Trenton, N. J. ..... A
Wood Electric Co., C. D., 565 Broadway, New York. (Sign Receptacles.) ..... A
Woodwin. See Wood Elec. Co.
Wrinklet. See Bryant Elec. Co.

SOLDER, Aluminum
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.
Aluminum Solder Corp. of America, 730 Fifth Ave., New York, N. Y.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Solderlume. See Aluminum Solder Corp. of America.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire
Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing
American Solder & Flux Co., 2910 N. 16th, Philadelphia
Chicago Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester. See Chicago Solder Co.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver
Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator
Tools. See Torches and Furnaces.

SOLDERING COMPOUNDS
Stick Paste, Flux Salts, Fluid.
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill. (Soldering, Stick Paste, Salts, Liquid Oil, Welder, Aluminum Flux, Fountain Brushes.)
American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Ameo. See American Solder & Flux Co.
Anchor. See Garden City Laboratory.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brubaker Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
Garden City Laboratory, 300 W. Adams, Chicago, Ill.
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leveridge, Inc., Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neer Co., L. F., Butler, O. (Flux and Solution.)
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammonica.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotax Mfg. Co., 380 E. 133rd, New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co.
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. (Paste.)
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Solderine. See Central Stamping Co.
Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co.
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa. (Paste).
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex R.
Yankee. See Leveridge, Inc., Chas. W.

SOLDERING IRONS
Acme Elec. Heating Co., Dept R, 1217 Washington, Boston.
Adroit. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
American Elecl. Heater Co., Detroit, Mich.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 713 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., 124 W. 18th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permwag Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper.)
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass.
National Specialties Co., Howell & Tyler Sts., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.

For those who want the best
SOLDERING FLUID
Non-poisonous, non-corrosive, economical, quick acting. Shipped in tin. A liberal sample free.
The Ruby Chemical Company
Columbus, Ohio

Reade's NON-CORROSIVE **SOLDERING FLUXES**
SOLDERING FLUIDS, SALTS, PASTES
Specialists in the manufacture of quality fluxes for 45 years.
Tell us your soldering problems.
READE MFG. CO., 133 Hoboken Ave., Jersey City, N. J.

THE CHAS. FISCHER SPRING COMPANY
Springs of every description. Flexible Shafts, Metal and Wire Specialties. Write for prices.

232 KENT AVE., BROOKLYN, N.Y.

Electro Magnet for Fire Alarm Systems

Inductance,
Choke,
Electro Magnet,
Ignition,

Medical,
Resistance,
Meter,
Transformer.

In fact, we make any type coil under the following classification:—paper section, layer-wound, cotton interwoven.

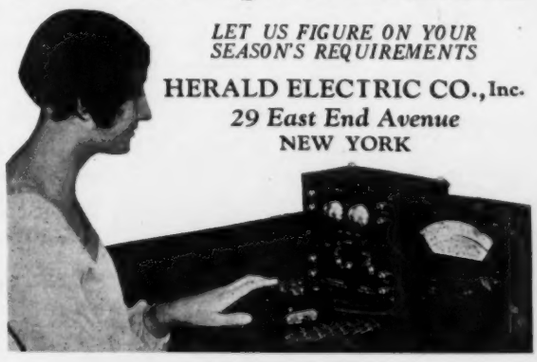
ACME PRODUCTS CO.
Boston, Mass.

The COIL is the HEART

of all electrical apparatus embodying it.

We know how to—

wind them
test them
insure them against breakdown



LET US FIGURE ON YOUR SEASON'S REQUIREMENTS

HERALD ELECTRIC CO., Inc.
29 East End Avenue
NEW YORK

The *right* Spring costs no more

DEPENDABILITY of springs as a part of your product is of more importance to you than initial cost. All things considered, when a spring is essential to the operation of any device the best is the cheapest, regardless of first cost.

GIBSON-SPRINGS

COMPRESSION EXTENSION
TORSION FLAT
ANY MATERIAL OR QUANTITY
ANY STYLE OR SIZE
ALSO LIGHT STAMPINGS

WM. D. GIBSON CO.

1800 CLYBOURN AVE.
CHICAGO
ILL.

SOLDERING IRONS—Continued
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio See Drake Elec. Wks.
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2633 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Superior Elec. Products Co., 1300 S. 13th, St. Louis, Mo.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec. Heating Co., 225 Varick, New York, N. Y.
Wagg Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Wellmade Elec. Co., Torrington, Conn.

SOLDERING MACHINES, Commutator
(For production soldering of small commutators).
Allatonce. See Chapman Electric Works, P. E.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.

SOLENOIDS. See Coils.

SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.

SPAGHETTI. See Tubing, Varnished Fabric.

SPEED CHANGING UNITS. See Gears (Speed Changing Units).

SPEED INDICATORS. See Tachometers.

SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS
Airway. See Binks Spray Equip. Co.
Babco. See Simons Paint Spray Brush Co.
Binks Spray Equipment Co., 3120 Carroll Ave., Chicago, Ill.
De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Eclipse Air Brush Co., 79 Orange, Newark, N. J.
Electric Sprayit Co., 320 E. Colfax Ave., South Bend, Ind.
Eureka Pneumatic Spray Co., 87 130th, Richmond Hill, N. Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y.
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Metal Specialties Mfg. Co., 338 N. Keeler Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill.
Presto. See Metal Specialties Mfg. Co.
Simons Paint Spray Brush Co., 1017 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill.
Sprayit. See Electric Sprayit Co.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.

SPREADERS, COIL & LOOP. See Winding Machines Armature & Field Coil.

SPRING MAKING MACHINES
Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS,
Advance Spring & Wire Co., Carroll & Wood St., Chicago.
Barnes-Gibson-Raymond, Inc., 6400 Miller Ave., Detroit, Mich.
Cary Spring Works, Inc., 240 W. 29th St., New York, N. Y.
Chapin Co., Chas. E., 227 Fulton, New York, N. Y.
Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 16 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1666 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Spring Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
Young Industries, Inc., L. A., Detroit, Mich.

STAMPED BOXES. See Cabinets, Sheet Steel.

STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel
Heavy Stamping and Drawing.
Acklin Stamping Co., 1925 Nebraska, Toledo, O.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bossert Corp., Utica, N. Y.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O.

STAMPINGS, Small
Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee.
Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Piano, Ill.
Hubbard Spring Co., M. O., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Kelly Brass Wks., 226 W. Ontario, Chicago, Ill.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.

Premax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Reliance Die & Stamping Co., 501 N. La Salle, Chicago.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Signal Elec. Mfg. Co., 1904 Broadway, Menominee, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. R., 68 E. 131st St., New York, N. Y.

STANDS, Armature
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).

STEATITE. See Cores, Resistance Coil.

STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances
Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet
Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS
Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Empire Steel Corp.
Uniloy. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.

STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers
Hall-Will, Inc., Erie, Pa.
Red-E-Hail. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator
Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 15th & Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel
Angle Steel Stool Co., Plainwell, Mich.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separators, Battery.
Tools. See Tools, Storage Battery.

STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEL
Acme Steel Co., 2840 Archer Ave., Chicago, Ill.
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Republic Iron & Steel Co., 335 Market, Youngstown, O.

STRIPPERS, Wire
Acme. See A. Laubscher.
Artos Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Service Sales & Mfg. Co., 17005 Melgrave Ave., Cleveland, Ohio.
Speedcraft. See Wire Stripper Co.
Wire Stripper Co., 508 Erie Bldg., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.

SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation; Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.

Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank.
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

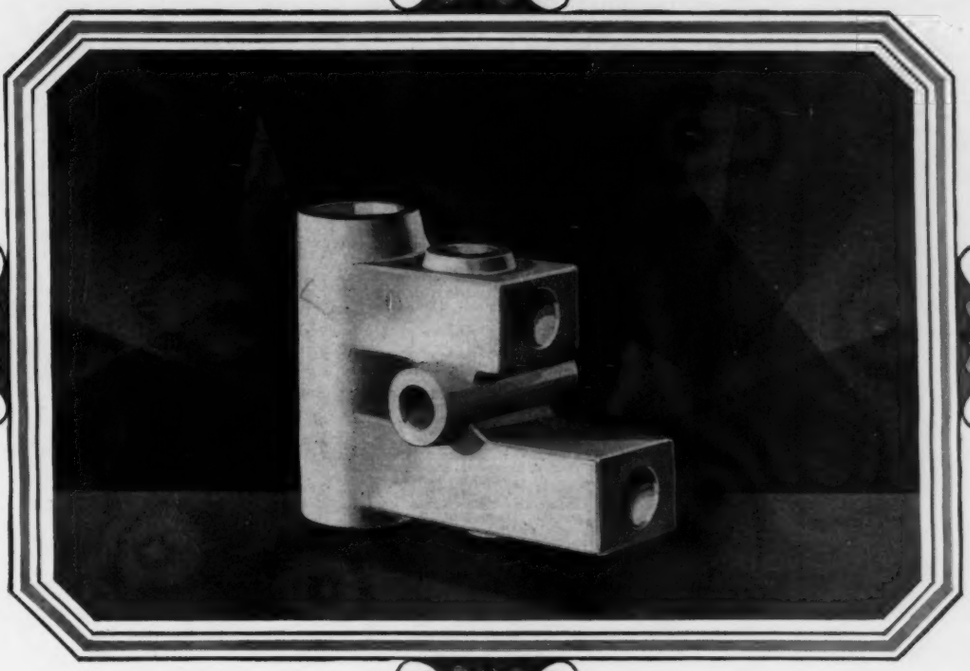
SWITCHES, Battery and Baby Knife
Cut-Out Switches.
Anti-Wood. See Kell & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2301 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Kell & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury
(For Temperature Control Apparatus.)
Cooper Hewitt Electric Co., 410 Eighth, Hoboken, N. J.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.

SWITCHES, Motor Starting
Accessible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., H. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co., 316 Colt, Irvington, N. J.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegmann & Co., E. M., 3611 N. 11th, St. Louis

SWITCHES, Remote Control
Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.

Evidence of Approval



The steadily growing demand for Newton Die Castings is convincing evidence of the approval which Newton Standards of Quality have earned. In automotive accessories, electrical appliances, office equipment, portable tools, and other specialty fields, Newton Die Castings are proving themselves dependable and economical. Nothing can take the place of Quality consistently maintained.

THE NEWTON DIE CASTING CORPORATION

146 MUNSON ST. NEWTON NEW HAVEN NEW HAVEN. CONN.

SWITCHES, Remote Control—Continued

Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer Mfg. Co., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectowitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

KEY

Feed Through ..... See p
Fixture (Canopy, Candelabra and Key Arm) ..... See F
Flush ..... See f
Lever, Toggle, Tumbler ..... See L
Pendant ..... See p
Push Button ..... See P
Rotary ..... See R
Surface ..... See s

See Also Switches, Snap; Heavy Duty.

Adam Electric Co., Frank, St. Louis, Mo. f . . . . . .
Anylite Elec. Co., Ft. Wayne, Ind. . . . . L .
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . f sp P R L F
Arrow Head. See Arrow Elec.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . f p P . . . F
Best. See United States Elec. Mfg. Corp.
Brascolite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. . . . . f . . . . . .
Bridgeport Switch Co., 209 Center, Bridgeport, Conn. . . . . L F
Bryant Elec. Co., Bridgeport, Conn. . . . . f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. . . . . F
Circle F. Mfg. Co., Trenton, N. J. . . . . f . . P . . L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . p P R L F
Crouse-Hinds Co., Syracuse, N. Y. . . . . L . .
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis. . . . . P . . . . L . .
Diamond H. See Hart Mfg. Co.
Dugie. See Bryant Elec.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . F
Gaynor Elec. Co., Bridgeport, Conn. . . . . f . . . . . L . .
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn. . . . f sp P R L F
Glo-Guide. See Bryant Elec. Co.
Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. . . . . F
Hart Mfg. Co., Hartford, Conn. . . . . f sp P R L . .
Hart & Hegeman Mfg. Co., Hartford, Conn. (Door Bolt Control.) . . . . . f sp P R L F
Hart. See Hart & Hegeman.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn. . . . sp . . . . L F
Jost. See Morse, Frank W.
Kell & Son, Francis, 401 E. 163rd, New York, N. Y. . . . . f . . P . . . . .
Leviten Mfg. Co., 226 Newell, Brooklyn . . . . . F
Levoller. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. . . . . f . . . . . L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. . . . . L F
Metropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y. . . . . s . . R . . . .
Morse Co., Frank W., 291 Congress, Boston . . . P . . . . .
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John I.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sts., Syracuse, N. Y. . . . . f sp P . . L F
Paulding, John I, New Bedford, Mass. . . . f s P . . . . .
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. . . . . L . . .
Pilotoggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. . . . . F
Rodale Mfg. Co., 200 Hudson, New York p . . . . . .
Sears, Henry D., 80 Boylston, Boston . . f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. . . . . P . . . . .
Snaplt. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. . . . . f s P R L . .
Trigle. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L . .
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. . . . . f . . . . . .
Victor. See Kell & Son, Francis.
Weber. See Sears, Henry D.
Workrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.

Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Penn Electric Machine Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank

Automatic Appliance Co., 236 N. St. Clair, Dayton, Ohio.
Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Tranern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. B., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1941 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1294 Folsom, San Francisco, Cal.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Cleveland. See D. J. Time Switch Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
D-J Time Switch Co., 1306 E. 14th, Cleveland, O.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
Tork Clocks, Inc., 12 E. 41st, New York, N. Y.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.

Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brooklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.

TANK SWITCHES. See Switches, Tank.

TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk;

Tape, Sleeving, Webbing.

Anchor Webbing Co., Nyc, Pawtucket, R. I. (Cotton, Silk.)
Awalco. See Anchor Webbing Co.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.

THERMOSTATIC METAL

For Low and High Temperatures

Our No. 1800 metal for temperatures up to 450° F.

Our No. 2800 metal for temperatures up to 1500° F.

W. M. CHACE VALVE COMPANY
1600 Beard Avenue. Detroit. Mich.

Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., 345 Campbell Ave., Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves. Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., P. O. Box 5077, Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Candee. See Ackurate Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Duncan, A. & B. See Okonite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.
Holdfast Rubber Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Impervo. See Canfield Rubber Co.
Irco. See Imperial Rubber Co.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Magnet. See Boston Woven Hose & Rubber Co.
Manson. See Okonite Co.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass
Red-X. See Louis Rubber Cement Co.
Rello. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co
Service. See Boston Woven Hose & Rubber Co.
Slipknot. See Plymouth Rubber Co.
St. Louis Rubber Cement Co., 3952 West Pine, St. Louis.
Star. See Sullivan & Sons Mfg. Co., J.
Sticks. See Graybar Elec. Co.
Stitzel. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis
2-Plex. See Holdfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Slic. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn
Ridlon Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.

TAPS. See Stocks, Dies and Reamers.

TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

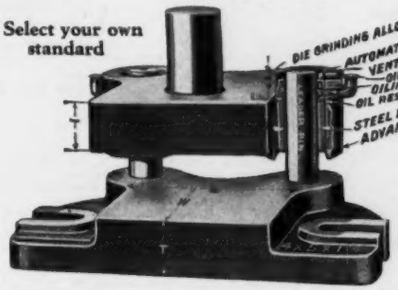
TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.

All-in-One. See Ohio Parts Co.
Barey-Nicholson Co., 2201 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Elsetron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kuller Elec. Mfg. Co.
Kuller Elec. Mfg. Co., 875 Pierce Ave., Long Island City.
Morse Co., Frank W. Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.

Get our new 120-page Die Set Guide
Listing 70,000 Sizes

Select your own standard



One of our endless styles and sizes

Baumbach Standard Automatic Oiled

DIE SETS

Made of 25% Steel

The Product That Built Our Modern Plant

E. A. BAUMBACH MFG. CO.
GENERAL OFFICE & WORKS
1810 SOUTH KILBOURN AVENUE, CHICAGO, ILLINOIS

ILLINOIS DIE CASTING CO.

FINISHED MECHANICAL PARTS
CAST OF "WHITE METAL" ALLOYS
ALUMINUM
ZINC
LEAD
AND TIN BASE

FACTORY - 551-571 W. CONGRESS ST.
OFFICE -- 503 S. JEFFERSON ST.

CHICAGO

CENTRAL
7813-4

BARNHART Die Castings in Chicago

WOULDN'T make the claim that it is because the castings themselves are better . . . we believe nearly all die castings are now dependable . . . but lay our gains to willingness, enthusiasm and the ability to move fast and effectively. If it's speed you want . . . big production . . . to hit the market quick and plenty, ours is the aggregation that will stick with you day and night until your fight is won.

BARNHART BROTHERS & SPINDLER
Monroe and Throop Streets ▼ CHICAGO, U. S. A.

TERMINALS AND CONNECTORS—Continued
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sta., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill.
TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments
Ace. See Weidenhoff, Joseph.
Allen-Bradley Company, 493 Clinton, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmeo. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Forest Electric Co., 372 New, Newark, N. J.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 477 Broadway, New York, N. Y.
Herald Elec Co., 35 East End Ave., New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kletzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Meco. See Metropolitan Mfg. & Elec. Co.
Metropolitan Mfg. & Elec. Co., 1163 Sedgwick, Chicago, Ill.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Forest Electric Co.
Portometer. See Forest Electric Co.
Portostat. See Forest Electric Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Servwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.
THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 20 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS

American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 100 Massachusetts Ave., Boston, Mass.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 6902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 20 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Manhattan Elec'l Supply Co., New York, N. Y.
Marvel. See American Thermostat Co.

Fischerarm

The best in flexible arms for portable and therapeutic lamps, etc.

MADE of steel and brass in all Finishes. Special arms designed to your requirements.

Write for prices.

CHAS. FISCHER SPRING CO.

238 Kent Avenue Brooklyn, N. Y.

Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 53rd, Brooklyn, N. Y.
Teeple Co., L. R., 540 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermomap. See Spencer Thermostat Co.
Trent Co., Harold E., 429 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.
TIME SWITCHES. See Switches, Time.
TINNING TANKS, WIRE. See Wire Manufacturing Machines.
TINSEL. See Wire, Insulated.

TIPS, Cord

Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S. 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.
TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery

Battery Equipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Beaco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heat-A-Knife. See Op-al Elec. & Mfg. Co.
Ibsco. See Illinois Battery Steamer Co.
Illinois Battery Steamer Co., Peoria, Ill.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES

Acetylene, Alcohol, Gasoline, Kerosene.
Bernz Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.
TORPEDO Cord. See Twine.
TORSION BALANCES. See Instruments, Laboratory Standard
TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Oil Burner.

TRANSFORMERS, Low and Intermediate Voltage

For Oil Burners, Gas Tube Signs, and other special purposes.
American Bosch Magneto Corp., Springfield, Mass.
American Transformer Co., Newark, N. J.
Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elect. Supply Co., 17 Park Pl., New York, N. Y.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraft Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.
TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power

Controller drive giving a variety of speeds for use in connection with coil taping machines.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.
TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.
TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel

Angle Steel Stool Co., Plainwell, Mich.
TRUING Devices, Commutator. See Tools, Commutator.
TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts.
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings

Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Pairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 38 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Bull Dog. See National Elec. Products Corp.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York
Cook, Dunbar Smith Co., 85 Sprague, Providence, R. I.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
National Electric Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic

(Flexible Tubing.)
Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Moulding Co., 146 Colt St., Irvington, N. J.
Auto-Brassflex. See National Metal Molding Co.
Auto-Steelflex. See National Metal Molding Co.
Breeze Metal Hose & Mfg. Co., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Riflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York

TUBING, Rubber

Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Faultless Rubber Co., Ashland, O.
Forestoc Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y

TUBING, Varnished Fabric

Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.
TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TWINE, Armature Winding; Torpedo Cord

Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Winne & Son, Frank W., 42 N. Front, Philadelphia, Pa.
UNDERCUTTERS, Mica. See Slotting Machines & Tools, Commutator.
UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance

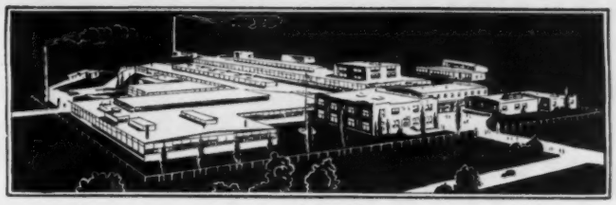
Acme Elec. Heating Co., Dept. B, 1217 Washington, Boston.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calrod. See Edison Elec. Appliance Co.
Carter Radio Co., 2422 Prospect Ave., Chicago, Ill.
Chromalax. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 83 Holten, Danvers, Mass.
Daric Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa
Elemite. See Louthan Mfg. Co.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.

Heating Unit Service

Manufacturers—Designers

INDUSTRIAL HEATER COMPANY

300 Canal Street New York, N. Y.



High Electrical Conductivity of "Handy" Silver Solders

Solders containing silver are replacing both hard and soft base-metal solders in many phases of electrical work because of their higher electrical conductivity—as well as numerous other advantages.

They have already found wide acceptance in the manufacture and repair of:

Airplanes
Automobile Engines
Burglar Alarms
Electrical Apparatus
Electric Household Devices
Electric Motors
Fire Alarms
Recording Instruments
Radio Loudspeakers
Refrigerators—Electric
Regulators, Electric
Splicing Wire and Cable
Telephones
Vacuum Tubes
X-Ray Devices
and numerous allied lines.

Electrical Conductivity

Silver is a better electrical conductor, even, than copper. Silver solders are used for welding resistors, rotor bars, in certain types of motors, and for many other electrical connections—especially, those in which either heat or vibration, or both, are encountereed.

"Handy" Silver Solders, standardized to certain fixed and guaranteed formulas, are especially valuable in holding resistance-values to a uniformly dependable figure.

Neat Compact Joints

As an exceedingly thin film of silver solder does the work of a much larger body of base-metal solders, its use is admirable for joints in which neatness and compactness are important.

Labor and Time-Saving

While the price, per ounce, of silver solder is necessarily somewhat higher than all-base-metal solders, their free-flowing properties, and the small quantity required, frequently make their use less expensive than the spelter or soft solders.

Other Valuable Characteristics

"Handy" silver solders flow freely, work fast and make neat, enduring joints that resist corrosion, vibration, shock, and relatively high temperatures.

They solder iron, steel, brass, copper, bronze, monel metal—in fact all metals fusing at 1400°F. or above.

Twelve Guaranteed Formulas

As a result of thousands of tests, "Handy" silver solders have been standardized to 12 different formulas. These mixtures differ mainly in the silver content—ranging from 80% down to 10%; and in melting point from 1325°F. up to 1600°F. Each solder has its distinct sphere of action; and the composition of each is guaranteed to be the same always.

All are offered in the form of sheet, strip, wire and filings.

A Valuable Booklet

Send for our new Handy Book of Silver Solder, "E." It contains much valuable information on soldering, brazing and welding.

HANDY & HARMAN

General Office:

57 WILLIAM STREET, NEW YORK CITY

PLANTS: Bridgeport, Conn. Providence, R. I. Fulton and Gold Sts., New York City

WAXES
AND
COMPOUNDS

to suit every requirement. Compounded to your specifications.

One-half million pounds standard grade in storage at all times assuring prompt shipment.

Samples on request.

NATIONAL WAX CO.
189 W. Madison St., Chicago, Ill.

UNITS, Rods & Grids—Continued
Gold Seal Elect. Co., 230 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hexwound. See Monitor Controller Co.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Krischer's Mfg. Co., 355 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
National Elec'l Supply Co., 1328 New York Ave., Washington, D. C.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind.
Parker & Co., J. C., 407 Bulletin Bldg., Philadelphia, Pa.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Resistance Laboratories, Inc., 20 W. 22nd, New York, N. Y.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Security Elec. Mfg. Co., 2638 Canton St., Chicago, Ill.
Sepco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N. Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Warren Elec. Appliance Co., Warren, Pa.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegand Co., Edwin L., 422 1st Ave., Pittsburgh, Pa.
Wirt Co., 5221 Greene, Philadelphia, Pa.

VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner

VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.

VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated

Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., ft. of Tolman, Boston, Mass. (Water.)
Crane Co., S. Michigan Ave., Chicago, Ill.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dual Automatic Valve Co., Rock Island, Ill.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1385 Fulton Bldg., Pittsburgh, Pa.
Liberty Electric Corp., Stamford, Conn.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Protect-U. See Zisch Engineering Corp.
Reading Steel Casting Co., Bridgeport, Conn.
Savutime Devices, Inc., 68 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-83rd St., Brooklyn, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Victor. See Lunkenheimer Co.
Zisch Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)

VARNISH. See Paint, Varnish, Lacquer.
VARNISHED TAPE. See Tape, Varnished Fabric.
VARNISHED TUBING. See Tubing, Varnished Fabric.
VOLT BOXES. See Instruments, Laboratory Standard.
VOLTMETERS. See Instruments.
VULCANITE. See Rubber, Hard.

VULCANIZERS, WIRE INSULATION

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Biggs Boiler Works, Akron, Ohio.

WASHERS, FIBRE. See Fibre.

WASHERS, Leather

Michigan Leather Washer Co., 548 E. Fort, Detroit, Mich.

WASHERS, Lock

Keystone. See Positive Lock Washer Co.
National Lock Washer Co., Newark, N. J.
Positive Lock Washer Co., Ave. A & Miller, Newark, N. J.
Shakeproof Lockwasher Co., 2513 N. Keeler Ave., Chicago.
St. Louis Malleable Casting Co., 7701 N. Conduit Ave., St. Louis, Mo.

WASHERS, Metallic

Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Massachusetts Machine Shop, Inc., Boston, Mass.
New England Screw Co., Dept. A., 44 Farnsworth, Boston.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Wrought Washer Mfg. Co., 46 S. Bay, Milwaukee, Wis.

WATTMETERS. See Instruments.

WAX AND COMPOUNDS

Wax and Compound, Sealing and Filling.....See W
Junction Box, Potheads, Battery Tops, Bolt Head Holes.

Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound .....See C
Ackurate Rubber Co., 25 Beaver, New York, N. Y. W
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.. S
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill.... W S
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S
Clifton Mfg. Co., 65 Brookside Ave., Boston.... C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. W S
Dolph Co., John C., 168 Emmet, Newark, N. J. W
Di Electric Puttie. See Ackurate Rubber Co.
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Section W-231, Merchandise Dept., Bridgeport, Conn. W
Globe Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O. W S
Gelco Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., 5133 Wesson Ave., Detroit, Mich. W
Hexsulate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York. W
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. C
Mineralac Elec. Co., 1045 Washington Blvd., Chicago, Ill. W
Mitchell-Rand Mfg. Co., 19 Vesey, New York.... W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind.... W
National Wax Co., 189 W. Madison, Chicago, Ill. . S
Nu-Blac. See Star Porcelain Co.
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. W
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.
Rub-Flexo. See Williams Co., F. M.
Seldner & Enequist, Inc., 86 Hausman, Brooklyn, N. Y. W
Sherwin-Williams Co., Cleveland, O. W C
Standard Varnish Wks., 433 4th Av., New York.. W
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. W S
Star Porcelain Co., Trenton, N. J. W C
Tacrite. See Seldner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. W S
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. S
Williams Co., F. M., 1238 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y. W

WELDS, Lamp Lead-In. See Filaments, Incandescent

WELDING AND CUTTING OUTFITS

Electric Arc, Spot, Butt and Seam Metal Welders and Metal Cutting Outfits.
Acme Elec. Welder Co., 1859 W. Fulton, Chicago, Ill.
A. E. F. See American Electric Fusion Corp.
Arnew Electric Welder Co., Milford, Mich.
Allan Mfg. & Welding Co., Inc., 736 Washington, Buffalo.
Almanc. See Allan Mfg. & Welding Co., Inc.
Alternare. See Electric Arc Cutting & Welding Co.
American Elec. Fusion Corp., 2610 Diversey Ave., Chicago
Ames Co., 115 Ninth, Brooklyn, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Electric Arc Cutting & Welding Co., 156 Jelliff Ave., Newark, N. J.
Electric Welding Co. of America, 744 Court, Brooklyn, N. Y.
Electric Welding Machine Co., 1530 Larned, E., Detroit.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Federal Machine & Welder Co., Dana Ave., Warren, O.
Fleet-Weld. See Lincoln Elec. Co.
Fusion Welding Corp., 103rd St. & Torrence Ave., Chicago.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.
Lincoln Electric Co., Cntt Rd. and Kirby Ave., Cleveland.
McAdams Co., J. C., 912 Second Ave., Long Island City.
Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
Ryerson & Son, Jos. T., 2558 W. 16th, Chicago, Ill.
Seneca Electric Welder Corp., 5057 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., 2567 W. Grand Blvd., Detroit.
Taylor-Winfield Corp., Mahoning Ave., Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Una Welding & Bonding Co., 1615 Collamer Ave., Cleveland, O.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Zeus. See Gibb Welding Machine Co.

WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WINDERS

Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil
Loop. See Winding Machines, Armature & Field Coil.

WINDING MACHINES, Armature and Field Coil

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.

WINDERS Spaced Resistor In Tube or Cord Types
Also for Dynamic Coils; Armatures; Radio and Electrical Transformers.
Vitreous Enamel Electric Ovens
FREDERICK M. CONRAN
177 New York Ave., Newark, N. J.

Cochrane's
WAXES
Compounds
Paints and Varnishes
for every insulation purpose
41 years in the business. Write for samples of our latest finishing and saturating wax.
Cochrane Chemical Company
Established 1887
432 Danforth Ave., Jersey City, N. J.

Comstock Mfg. Co., Wilkes-Barre, Pa.
Conron, Frederick M., 177 New York Ave., Newark, N. J.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Globe Technolian Corp., Reading, Mass.
Fredericks Co., H. M., Lock Haven, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Herald Elec. Co., 35 East End Ave., New York, N. Y.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., W. Fort & Minnie Sts., Detroit, Mich.
Line, W. C., 208 S. Geddes, Syracuse, N. Y.
Lyknu. See Fredericks Co.
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.
Mutual Foundry & Machine Co., Atlanta, Ga.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Conron, Frederick M., 177 New York Ave., Newark, N. J.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electrical Products Mfg. Co., Providence, R. I.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Line, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 212 Centre, New York.
Bidlon Company, Frank, 253 A St., Boston, Mass.
Universal Winding Co., Boston, Mass.
Weber & Scher Mfg. Co., 263 Sussex Ave., Newark, N. J.
Weehawken Engineering Co., 543 Gregory Ave., Weehawken, N. J.

WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

Athey Co., 6112 West 65th St., Chicago, Ill.

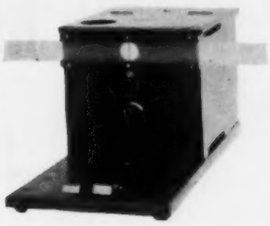
WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire;
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

Armature Banding .....See S
Copper Wire .....See C
Iron Wire .....See S
Phosphor Bronze .....See R
Radio Bus Wire .....See C
Resistance Wire .....See R
Steel Wire .....See S

Acme. See Alloy Metal Wire Co.
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa. C R
American Brass Co., 25 Broadway, New York,
American Copper Products Corp., 233 Broadway, New York, N. Y. C R
American Electrical Works (Phillipsdale), Providence, R. I. C
American Insulated Wire & Cable Co., Div. of General Cable Corp., 954 W. 21st, Chicago.... C R
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. C R
Anaconda. See American Brass Co.
Anylite Elec. Co., Fort Wayne, Ind. C
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md. C
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. C
Belden Mfg. Co., 2310B S. Western Ave., Chicago C R
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass. R
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn. C
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Hardy Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa. C R
Cornish Wire Co., 30 Church, New York, N. Y. C
Corwico. See Cornish Wire Co.
Crapo. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. C
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y. C
Detroit Insulated Wire Co., Detroit, Mich. C
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J. R
Electron. See Bassett Metal Goods Co.
Excellcier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa.
Gilby Wire Co., Riverside Ave., Newark, N. J. R
Goldmark Co., James, 83 Warren, New York.. C
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) C
Hoskins Mfg. Co., Detroit, Mich. R
Hudson Wire Co., Ossining, N. Y. C R
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. C R
Indiana Steel & Wire Co., Muncie, Ind. R

Make your quantity inspections with more speed, ease and safety with this



HIGH SPEED TESTING INSTRUMENT

This apparatus has proven through several years' continuous use in the largest industrial plants, that it is decidedly superior. It is a comparison testing bridge, designed especially for rapid testing of large quantities of resistances, coils, heaters, etc. Untrained operators can operate it safely, and inspect as much as 500 pieces per hour without fatigue.

This instrument is representative, in workmanship and quality of material, of our entire line of electrical measuring instruments. This includes Wheatstone Bridges, Galvanometers, Rheostats, Resistance Boxes, Condensers, Inductances, Potentiometers, Salinity Indicators, Electrolytic Apparatus, Magnetic Testing Apparatus and Cable Testing Instruments.

Send us your special requirements and let us help you meet them.

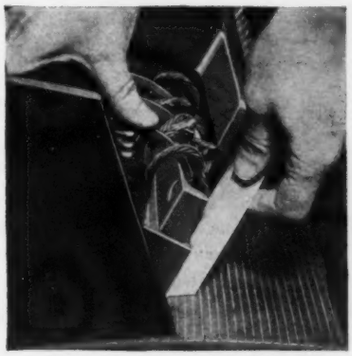
THE RUBICON COMPANY

29 N. Sixth Street Philadelphia, Pa.

Labor is costly—

Save it with

DIAMOND-D BRUSH SEATERS



Put a true seat on any brush in less than a minute !

Just hold a Brush Seater at the heel of any brush, with the machine running, so that the revolving commutator or ring carries some of the Brush Seater material under the brush. In less than a minute, without manual effort, you have a perfectly seated brush with complete contact over its entire face. And you have saved more than 75% of the time ordinarily required.

Let us send you a dozen on approval. Try them—and if they are entirely satisfactory, they'll cost you but $6.00. If you are not satisfied, there will be no charge. Don't you think it is worth a trial?

Co-Operative Utilities Co., Inc.

15th and Columbia Avenue, Philadelphia, Penna.

Sherman Soldering Lugs

The approved standard, complete line of perfect efficiency

Listed by the Underwriters

Look for this marking

Electrical manufacturers used to make their own soldering lugs, because there was no complete, accurate line generally stocked. Now any jobber can furnish you with Sherman Soldering Lugs in standard sizes and designs carefully conformed to the Underwriters requirements. Sherman Lugs are *approved*, guaranteeing their efficiency. In sizes up to 15/16" O. D. they are the popular type made under the Sherman Patent. They are seamless, have better conductivity, and solder cannot leak out. In sizes 15/16" O. D. and up, Sherman Soldering lugs are made only of seamless copper tubing of correct gauge. Round end lugs are generally recommended, but square end lugs are furnished if specified.

Special lugs can be had to specification, but only those coming up to the Underwriters standards can be stamped as approved fittings.

Made only of pure seamless copper~

Sherman Soldering Lugs are made by the world's most experienced makers of electrical connectors, and they are more accurate, better looking and economical.

Sold through Jobbers

H. B. SHERMAN MFG. CO.

Battle Creek, Michigan

—GILBY WIRE—
COMPANY
WILBUR B. DRIVER, President
Manufacturers of
RESISTANCE WIRES
—round and flat, fine wires, strip. Heat and acid-resisting castings. Special alloys. We can advantageously fill your requirements.
"TOPHET A" (formerly SOLAR) "TOPHET C" (formerly Tophet)
"CUPRON"
RIVERSIDE AVENUE, NEWARK, N. J.

WIRE, Bare—Continued
Inland Wire & Cable Co., Sycamore, Ill..... C
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C
Monarch Elec. & Wire Co., 622 W. Adams, Chicago C .. S
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 113 Orchard, Newark... .. R ..
Nehring Electrical Works, De Kalb, Ill. C
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn..... S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. C
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C
Race. See Ross Wire Co.
Resolute Wire Co., Hastings-on-Hudson, N. Y.... C
Roebling's Sons Co., John A., Trenton, N. J..... C .. S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. C
Ross Wire Co., 69 Bath, Providence, R. I..... C
Silcrimp. See Valley Narrow Fabric Co.
Seneca Wire & Mfg. Co., Fostoria, O. ..... S
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y..... C
Standard Alloy Wire Co., Elizabeth, N. J. ..... R S
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. C
Super-Insulated Wire Co., Plymouth, Mass. C
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C

WIRE, Copper Clad

American Steel & Wire Co., 208 S. La Salle, Chicago, Ill
Copperweld Steel Co., Rankin, Pa.
Standard Underground Cable Co., Pittsburgh, Pa.

WIRE SOLDER. See Solder, Bar and Wire.

WIRE DRAWING MACHINES

Drawing and Re-drawing Mill Equipment for Small Wires
American Insulating Machinery Co., 519 Huntington Ave. Philadelphia, Pa.
Sleeper-Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., 70 Franklin, Torrington Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Con..

WIRE, Insulated

KEY
Annunciator, Office, Bell Wire....See A
Asbestos Covered Heater Cord.....See H
Asbestos Covered Magnet Wire....See M
Enameled Magnet Wire .....See M
Fixture Wire .....See R
Flexible Reinforced Heavy Duty Cord .....See F
Heater Cord .....See H
Ignition Cable .....See R
Lamp Cord .....See R
Magnet Wire .....See M
Rubber Covered Wire & Cable..See R
Stove Wire .....See H
Telephone Cord .....See T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn.
Enamaled Silk, Cotton ..... M
Amelectric. See American Elec.
American Brand. See American Insulated Wire & Cable Co.
American Brass Co., 25 Broadway, New York, N. Y..... A .. M ..
American Copper Products Corp., 233 Broadway, New York, N. Y.....
American Electrical Works (Philipsdale). Providence, R. I..... M
American Enameled Magnet Wire Co., Muskegon, Mich. ..... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st. Chicago, Ill. ..... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I..... R F .. A T ..
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerize. See American Steel.
Amparak. See American Steel.
Anaconda. See American Brass Co.
Ansonia Electrical Co., Ansonia, Conn. Silk, Cotton, Enameled..... A .. M
Armoriokt. See American Steel
Bay State Insulated Wire & Cable Co., Paydras (Mattapan), 26, Boston..... R .....
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill. ..... R F H A T M
Beldenamel. See Belden Mfg. Co.
Beldenite See Belden Mfg. Co.
Bishco Wire & Cable Corp., 420 E. 25th, New York, N. Y..... R F .....
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H ...
Bradford, Kyle & Co., Plymouth, Mass. ..... M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H .....

Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa..... R .....
Cotenamel. See Belden Mfg. Co.
Cottomite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 97 Greene, New York, R .....
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T ..
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R ..... T ..
Diamond Braiding Mills, Chicago Heights R F H .....
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R .. H .....
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.. ..... M
Durabilt. See Tubular Woven.
Duracord. See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .....
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. ..... F .....
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. ..... T ..
GE-Flex. See General Elec. Co.
General Asbestos & Rubber Co., Charleston, S. C. ..... H .....
General Elec. Co., Section W-231, Merchandise Dept., Bridgeport, Conn.... R F H .... M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R ..... T ..
Grimshaw. See New York Ins.
Hatfield Rubber Wks., Inc., Hillside, N. J. R .. H .....
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F .. A ..
Holyoke Co., 621 Broadway, New York.. R ... A .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H .....
Inland Wire & Cable Co., Sycamore, Ill. R W .. A ... M
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R .....
Kilo, Co., 2 E. 23d, New York..... T M
Koellis, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. ..... T ..
Liberty. See Nat. Metal Molding.
Lowell Insulated Wire Co., Lowell, Mass. R F H .....
Loxsteel. See Hazard Insulated Wire Works.
McEvoy, C. H., Lowell, Mass..... R ..... T ..
Maring Wire Co., Muskegon, Mich. Cotton, Silk, Enameled ..... M
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T ..
Massachusetts Elec. Mfg. Co., West Lynn, Mass. ..... M
Monarch Elec. & Wire Co., 622 W. Adams, Chicago, Ill. ..... A ...
Montgomery Co., J. R., Windsor Locks, Conn. ..... T ..
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa..... R F H A T M
N. E. See Goldmark Co., James.
New England Wire Co., Westfield, Mass.. R .. H .. T ..
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .....
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co.
Okocord. See Okonite Co.
Okonite Co., Passaic, N. J..... R .....
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O..... R F .....
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco. See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa..... .. H A T ..
Phillips Wire Co., Pawtucket, R. I..... R .....
Provident Insulated Wire Co., Providence, R F H A ...
Raven Core. See New York.
Reliance. See American Steel.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn..... R .. H .. T M
Roebling's Sons Co., John A., Trenton, N. J ..... R F H A T M
Rome Electrical Co., Rome, N. Y. ..... M
Rome Wire Co., Rome, N. Y..... R F H .. T M
Ross Wire Co., 69 Bath, Providence, R. I.. R .....
Ruppel-Lenz Elec Mfg. Co., 1751 N. Western Ave., Chicago, Ill..... T ..
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H .....
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R .....
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F .....
Shield. See Ansonia Elec'l Co.
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .... H .....
Standard Insulated Wire Co., Westfield, Mass. ..... R .. H .....
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T ..
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass ..... R .....
Strand & Sweet Mfg. Co., Winsted, Conn. ..... M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit & Cable Co., Dry Harbor Rd. & Cooper Ave., Brooklyn..... R .....
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F .....
United States Rubber Co., 1790 Broadway, New York, N. Y..... R .. H A T ..
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. ..... M
Warrior. See American Copper.

For Supreme Musical Performance
THORDARSON
AUDIO & POWER TRANSFORMERS
THORDARSON ELECTRIC MFG. CO.
Transformer Specialists Since 1895
Huron and Kingsbury Sts., Chicago, Ill.

Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1123 Oliver, Philadelphia, Pa. ..... R F H .. T ..
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y..... R .. H .... M

WIRE, Steel Flat

Steel Coating for Armored Conductor.
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Crescent Insulated Wire & Cable Co., 319 N. Oden Ave., Trenton, N. J.
Roebling's Sons Co., John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE MANUFACTURING MACHINES

(See Also Wire Drawing Machines; Insulation Mixers; Taping Machines, Wire; Wire Polishing Machines; Enameling Machines for Magnet Wire; Wire Wrapping Machines; Vulcanizers, Wire Insulation.)
Armoring Machines .....See A
Braiding Machines .....See B
Bunching Machines .....See S
Covering Machines .....See I
Insulating Machines .....See I
Insulation Straining Machines.....See I
Measuring Machines .....See M
Park Cabling Machines.....See A
Saturating Tanks .....See F
Spooling Machines .....See U
Stranding Machines .....See S
Tinning Tanks .....See F
Winding Reels .....See U
Adamson Machine Co., Akron, Ohio.. I A .....
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A .... S U F
Breguet. See American Insulating Machy.
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. ..... M .. U ..
Housatonic Machine & Tool Co., Bridgeport, Conn. ..... I ..... U ..
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. ..... M .. U ..
Nebutteo. See New England Butt Co.
New England Butt Co., 334 Pearl, Providence, R. I. ..... I A B M S U ..
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I .....
Sleeper & Hartley, Inc., Worcester, Mass. ..... A .... S U
Terkelson Machine Co., 326 A St., Boston, Mass. ..... M .....
Textile Machine Works, Reading, Pa. .... B .....
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. ..... A ..... U F
Utility Mfg. Co., Cudahy, Wis. ..... I .....
Wardwell Braiding Machine Co., Central Falls, R. I. ..... B .....
Watson Mfg Co., Paterson, N. J. I A .. M S .. F
Wire Machinery Corp. of Am., New Haven, Conn. ..... M S U ..
Weir. See Housatonic Machine

WIRE POLISHING MACHINES

(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
New England Butt Co., 334 Pearl, Providence, R. I.

WIRE STRAIGHTENING MACHINES

Kane & Roach, Syracuse, N. Y.
Shuster Co., F. B., New Haven, Conn.

WIRE TAPING MACHINES. See Taping Machines, Wire.

WIRE VULCANIZING MACHINES. See Vulcanizers Wire Insulation.

WIRE WRAPPING MACHINES

Terkelson Machine Co., 326 A St., Boston, Mass.

WOOD BLOCKS. See Cabinets & Boxes, Wood.

Boxes. See Cabinets & Boxes, Wood
Cabinets. See Cabinets & Boxes, Wood
Pulleys. See Pulleys, Composition.
Woods Metal. See Radio Mountings.

WRAPPERS, Paper. See Boxes and Wrappers.

WRAPPERS, Tungsten Lamp. See Boxes and Wrappers.

WRAPPING MACHINES, WIRE. See Wire Wrapping Machines.

YARN AND THREAD; Silk, Cotton, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
Florsheim, H. A., 225 Fifth Ave., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Great Lakes Yarn & Thread Co., 5133 Wesson Ave., Detroit, Mich.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y. (Asbestos.)
Multiple Winding Co., 77 Summer, Boston, Mass.
Rich & Co., H. S., 180 S. Water, Providence, R. I.
Ryle & Co., Wm., 381 Fourth Ave., New York, N. Y.
Silkslip. See Worcester Bleach & Dye Wks. Co.
Smith & Dove Mfg. Co., Andover, Mass. (Linen Thread.)
Worcester Bleach & Dye Wks., Worcester, Mass.

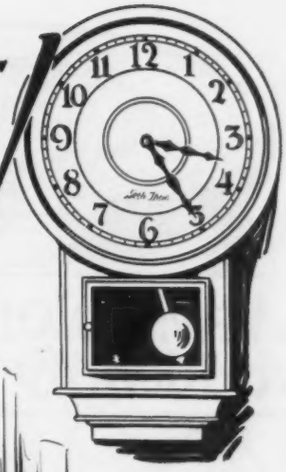
ZINC

Horse Head. See New Jersey Zinc Co.
New Jersey Zinc Co., 160 Front, New York, N. Y
Platt Bros. & Co., Waterbury, Conn. (Strips.)

ZINCS AND COPPERS, Battery

Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Edes Mfg. Co., Plymouth, Mass.
Extruded Metal Corp., 184 53rd, Brooklyn, N.Y. (Zinc Cups.)
Franklin. See Grasselli Chemical Co.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Illinois Zinc Co., Peru, Ill.
Lind Mfg. Co., 70 Wyckoff Ave., Brooklyn, N.Y. (Zinc Cups.)
Mattiessen & Hegeles Zinc Co., La Salle, Ill.
New Jersey Zinc Co., 160 Front, New York, N. Y.

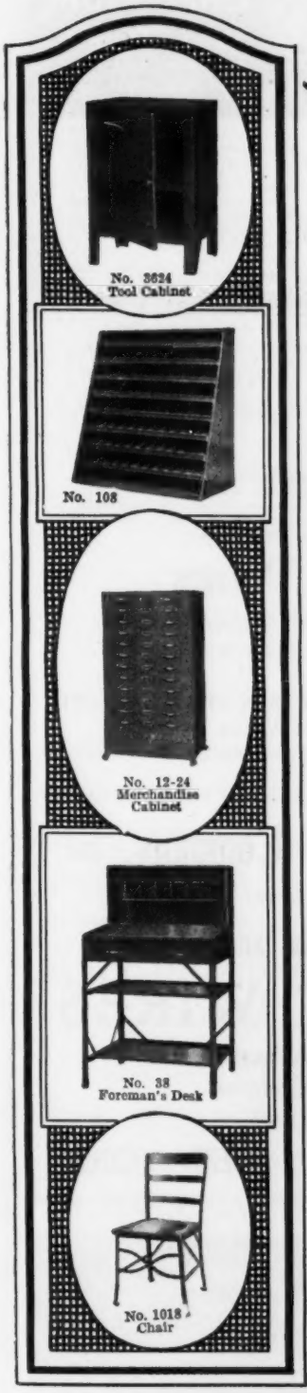
When Minutes mean—Days and Dollars!



When "RUSH!" is the order, then is when ANGLE STEEL EQUIPMENT is most valued and appreciated. For this complete line is time-, labor- and dollar-saving.

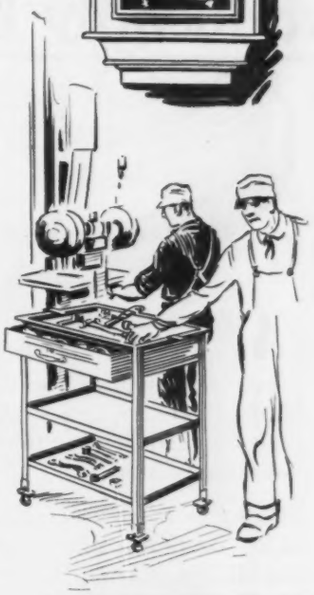
Manufacturers in the electrical field are cutting costs and plus-ing their production by the sensible, systematic and sane use of this modern factory and office equipment.

Send for Catalog "C" today.



No. 218-DC Machine Tender Truck

Strong, well-built and widely useful. Made of 1¼" angle steel and 16 gauge black sheet steel. Two lower shelves have turned-down edges in front. Lock drawer, four swivel casters and hand-riveted joints. Rich, dark olive-green lacquer finish.



This No. 110 Stool is furnished with or without shaped steel back.

ANGLE STEEL STOOL COMPANY

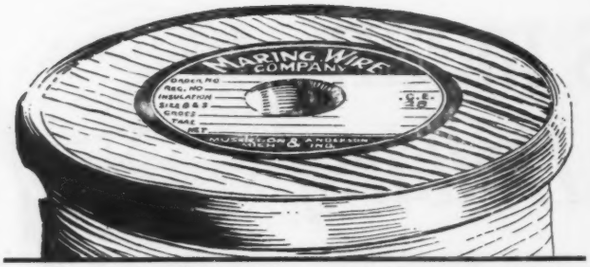
Plainwell **Michigan, U. S. A.**

New York City—Angle Steel Stool Sales Co., 98 Park Place Chicago—Lothrop Angle Steel Equipment Co., 325 W. Madison St.

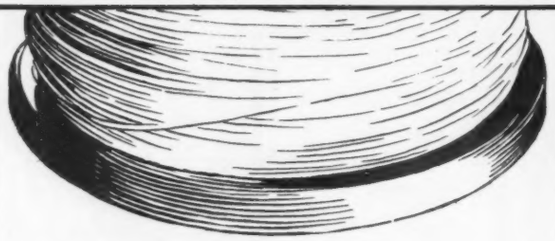
Permanence in Steel

ANGLE STEEL EQUIPMENT

ECONOMICAL - SANITARY - DURABLE



New! Colored Labels to Identify Insulations!



AGAIN "MARING" keeps in step with progress. These new helpful labels instantly identify the insulation of MARING Magnet Wire *by color*. Reading of the label inscription is unnecessary. Errors are eliminated too.

Post this advertisement in your stockroom. Let it familiarize your stockmen with MARING Magnet Wire *by color*.

Label Color

Gold	Plain Enameled
Red	Single Cotton Enameled
Orange	Double Cotton Enameled
Peacock Blue	Single Cotton Covered
Dark Blue	Double Cotton Covered
Yellow	Single Silk Enameled
Brown	Double Silk Enameled
Green	Single Silk Covered
Light Lavender	Double Silk Covered
Black	Twin Conductor

MARING WIRE COMPANY
MUSKEGON MICH., U. S. A.
Branches in Principal Cities

MARING
Magnet Wire

STANDARD
Nickel Chromium
RESISTANCE WIRE
A grade for every need

We are manufacturers exclusively of high grade resistance alloys.
Standard Nickel-Chromium "A," "C," and "D" and Standard Novar cover all ordinary resistance requirements; for high grade electric cooking and heating appliances, industrial furnaces, rheostats and controllers, and electrical testing and measuring instruments, radio rheostats, resistors, thermo-couples, etc.
We make these and other resistance alloys in wire, ribbon or strip, either bare or insulated.
Catalog and prices sent on request
STANDARD ALLOY WIRE CO., *Elizabeth, N. J.*

Standard Thermostatic Metal — *Non-Rusting Thermostatic Metal*

A NEW combination of metals perfected to avoid the necessity of extra processing when contact with steam or water makes the use of other thermostatic metals impractical. Little loss of sensitivity. Made in all sizes and shapes for every application.

Contact Points
[*in Platinum, Silver and Alloys*]
Interstate Products Corporation
29 Commercial Street. Newark, N. J.

Rome Electrical Company, Inc.
Manufacturers of
Twin, Round, Flat and Square
MAGNET WIRES
Cotton, Silk, Asbestos and Enamel Covered
Write for Prices
ROME NEW YORK

Precision Work plus Timely Service
METAL PRODUCTS
Wire Forms
Metal Stampings
Machine Screws
Battery Connectors
Screw Machine Products
Clark Metal Products, Inc.
490 Hancock Avenue
Bridgeport Conn.

Among the Satisfied Users of

Ambler Ebonized Asbestos Lumber

A. B. SEE ELEVATOR COMPANY

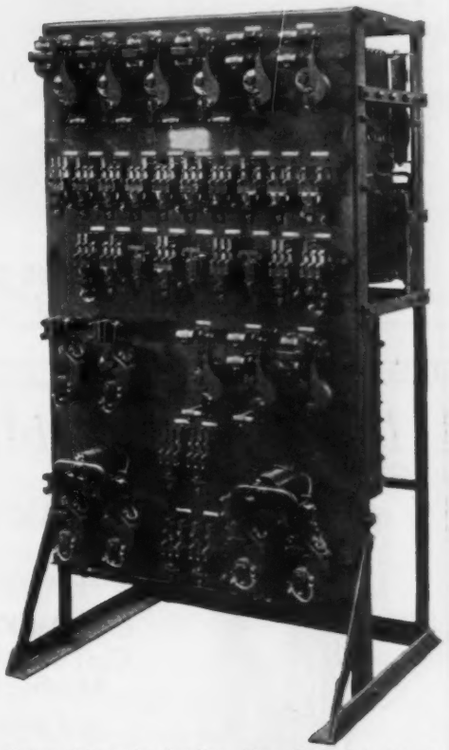
uses Ambler Ebonized Asbestos Lumber for all switchboards, terminal blocks, switch insulation, junction box panels, and other places where material of high insulating quality is required, combined with ease of drilling holes for mounting various apparatus.

An official of the A. B. See Elevator Company writes:

"We are more than pleased to give your material our hearty endorsement."

Ambler Ebonized Asbestos Lumber is known and used throughout the electrical industry. Public Utilities have endorsed this product and are constant buyers. Many electrical manufacturers can find in it the qualities they are seeking for switchboard and allied uses.

Ambler Ebonized Asbestos Lumber is made of asbestos fibre and Portland cement, impregnated with a specially developed compound giving great di-electric strength.



Latest Automatic Landing Type D.C. L-2 No. 6 Switchboard of A. B. See Elevator Company, with main panel, operating switch panel and terminal boards of Ambler Ebonized Asbestos Lumber.

AMBLER EBONIZED ASBESTOS LUMBER MEETS ALL U. S. NAVY SPECIFICATIONS AND IS APPROVED BY THE UNDERWRITERS LABORATORIES.

A trained engineering staff is ready to survey your needs. Address your inquiries to—

Asbestos Shingle, Slate & Sheathing Company

Executive Offices: Ambler, Penna.; St. Louis, Mo.

Factories: Ambler, Penna.; St. Louis, Mo.

Branches: Boston, Buffalo, Chicago, Cleveland, Detroit, Milwaukee, Minneapolis, New York City, Philadelphia, Pittsburgh, Omaha, Washington, Wilkes-Barre

GORTON
RACINE, WIS., U.S.A.

Complete NEW Line of

DIE SINKING and ENGRAVING MACHINES offer many types and sizes — Accurate and Durable — Over 1000 in use. Also—

ROUTERS and VERTICAL MILLERS of entirely NEW design. Novel construction and patented features permit larger capacity — easier operation and greater accuracy. Ask about the GORTON 8-D Vertical Miller.

We have made a specialty of Die-sinking & Engraving Machines for 35 years. Send us your problems.

GEORGE GORTON MACHINE CO.
Racine, Wisconsin

COMMUTATORS

for all types of

GENERATORS, STARTERS, MOTORS, FAN MOTORS

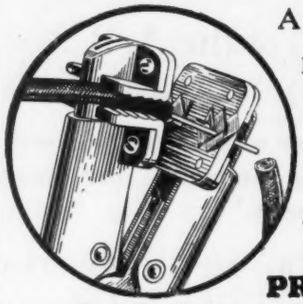
We specialize in commutators for high speed motors.

Let us estimate on your requirements

THE DERBY COMMUTATOR CO.
Derby, Conn., U. S. A.

E-Z WIRE STRIPPER

A HANDY TOOL *for all* MANUFACTURERS

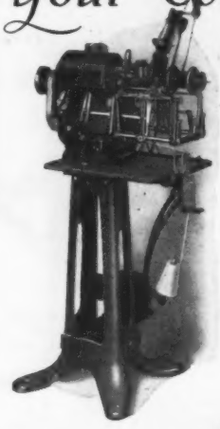


Here is a tool that will save you time and money, speed up production and lower your costs.

This inexpensive tool strips wire of 10 to 20 gauge 20 times faster than usual methods. Give it a trial on a money back guarantee. Thousands in use.

PYRAMID PRODUCTS CO.
2311 South State St., Chicago, U. S. A.

Your Coil Problem Solved!



Install a group of "*Universal*" Coil Winding Machines and insure uniform production of dependable coils at surprisingly low cost

or

Purchase these same coils from us, carefully wound to your specifications and ready for application to your product

UNIVERSAL WINDING COMPANY
LEESONA
BOSTON

Automatic Metal Stampings

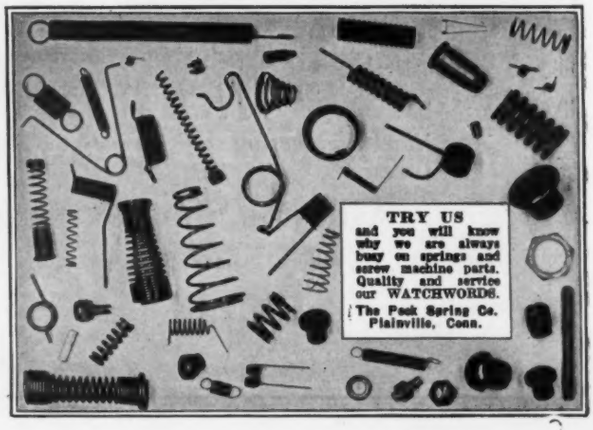
71

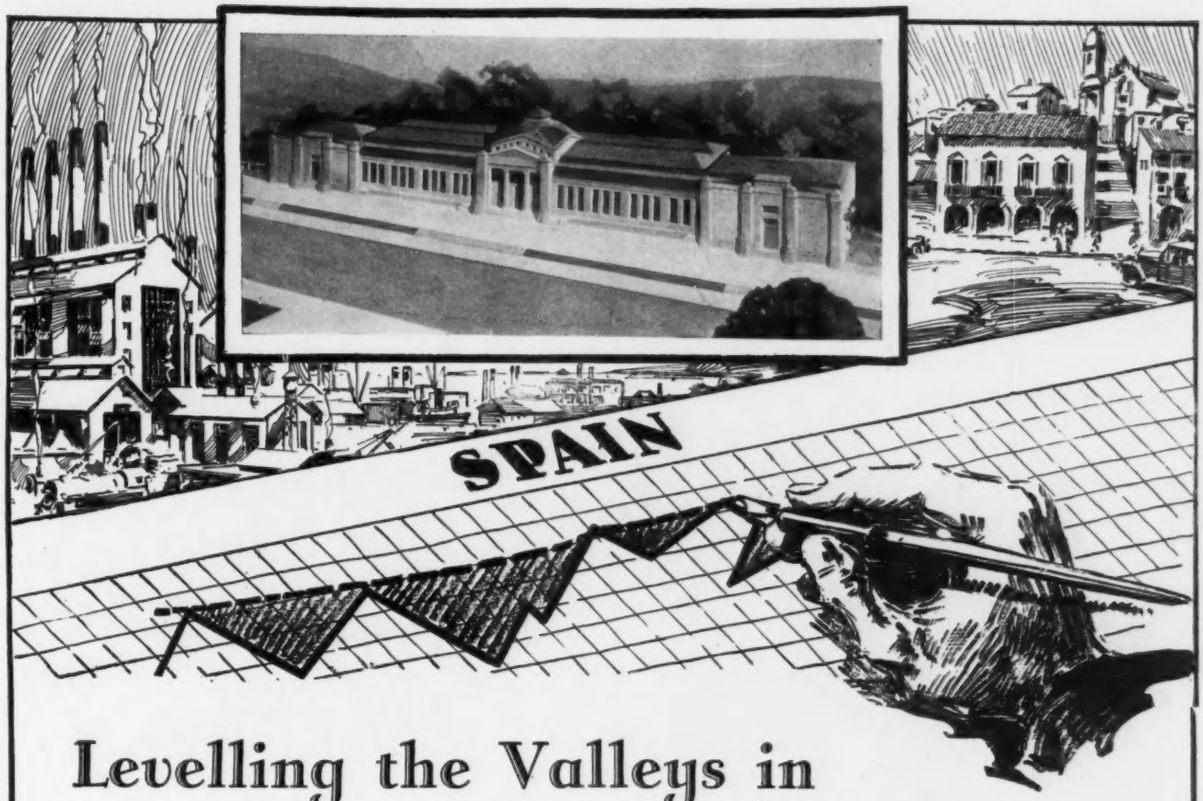
65

Brass and copper stampings are our specialty; our card of standard lugs, terminals and socket springs will help you in ordering. For special work, we are glad to quote on your blueprints or specifications.

Samples show what we do—ask for them

F. R. ZIERICK MACHINE WORKS
68-72 East 131st St. New York, N. Y.


TRY US
and you will know why we are always busy on springs and screw machine parts. Quality and service our WATCHWORDS.
The Peck Spring Co.
Plainville, Conn.



Levelling the Valleys in the Production Schedule

More and more American manufacturers are turning to Export, not only for the *immediate* profitable business it offers, but as a permanent solution for the problem of production "valleys."

The American manufacturer who is doing a volume export business finds his production schedules levelled the year 'round.

When it is winter in South America, it is summer in Spain. When the selling season is closing in one market, it is opening in another market.

World markets offer a perfectly balanced wheel of year 'round sales.

The Exhibition of Barcelona 1929 is the American manufacturer's gateway to win not only the rich, fertile Spanish market (Spain is third wealthiest of world powers), but also to attract and interest the buyers of the 23 other countries of the world, who are being urged to attend through a world-wide advertising campaign.

Special low freight rates . . . arrangements for no tariff on materials for exhibit . . . exhibition space without charge for American manufacturers seeking the Spanish market.

We have an especially interesting message to those manufacturers who have not developed their export business—particularly for Spain.

U. S. Delegate, Exhibition of Barcelona, Dept. 313, Steinway Hall, New York City

International Exhibition Barcelona

MAY—1929—DECEMBER

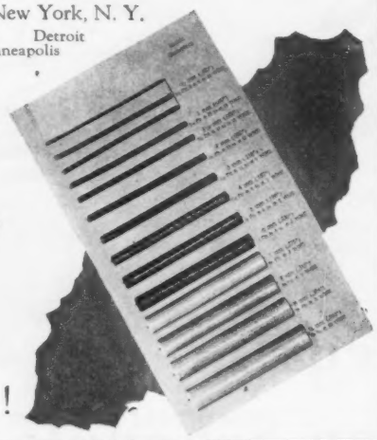
Bend it - twist it - pull it - give it "the works"—

—put Turbo Oil Tubing through a stiff breakdown test; only in that way will you find out what a flexible, tough lead wire insulation it is. Weather, water, oils and acids have no effect on Turbo (high grade spaghetti), for it is impregnated and baked through and through, not dipped. Just ask for the free sample booklet; you are under no obligation to us, but in justice to yourselves you ought to test Turbo Oil Tubing.

TURBO OIL TUBING

William Brand and Co.
268 4th Avenue, New York, N. Y.
Chicago St. Louis Detroit
San Francisco Minneapolis

Also makers of mica products, condenser paper, Turbo filling compound.



With our FREE Sample Booklet it's easy!

CASE BROTHERS
INCORPORATED
Highland Park, Conn.

Manufacturers of

Insulating Papers and Boards

Press Boards

Fuller Boards

ELEPHANT BRAND "Phosphor Bronze"
SEAMLESS COLD DRAWN BUSHING STOCK
IN RANDOM MILL LENGTHS

On walls 3/32" and over you get over 90% finished to required size with hole concentric.

Not counting cutting-to-length waste.

WHERE holes are too small to core in long lengths and too large to bore from solids we now make a special tubing of Elephant Brand "Phosphor Bronze" No. 130 Bearing Metal.

Tubing walls that are 1/4" thick and under have .005 of extra metal on each surface so you can make the hole concentric. Sufficient material for the work yet very little waste to throw away.

When the bearing holes are very small use rod of the same material. When they are too large with heavy walls use the cast bushings of Phosphor Bronze S Bearing Metal. We carry a stock of 170 sizes for your requirements.

ELEPHANT BRAND
REG. U.S. PAT. OFF.
"Phosphor Bronze"

The Phosphor Bronze Smelting Company
2200 Washington Ave. Philadelphia, Pa.

Pure Zinc for Fuse Elements

Strip Zinc for Commercial Uses

Eyelets Standard & Special

Large Articles Made on Multiple Plunger Press

The Platt Bros. & Co.
Waterbury, Conn.

A FACTORY ORGANIZED TO TAKE CARE OF THE SPRING REQUIREMENTS OF THE ELECTRICAL INDUSTRY

The Wallace Barnes Co.
"Spring Makers for Three Generations"
Bristol, Conn.

Quality is Priceless

Every second of the twenty-four hours of the day a check is maintained on all materials and processes involved in the making of Rogers Press Board to safeguard its high standard.

The
ROGERS PAPER
Manufacturing Co.
South Manchester, Conn.

Glassine Paper

We have manufactured and supplied glassine paper for insulating to the Electrical Trade for 25 years.

Made in various thicknesses
.00065" and up
± .00005"
Sheets and perfect rolls
½" wide and up
± 1/64"

On contract orders will carry your paper in stock so that we can make immediate shipment when required.

Hartford City Paper Co.

Main Office and Mills at
HARTFORD CITY, IND.

Eastern Office
1001 Woolworth Bldg.
New York City, N. Y.

Midwestern Office
618 1st Nat'l Bank Bldg.
Chicago, Ill.

ELECTRITE

A high grade fibre board for electrical insulation.

A material of quality possessing high tensile and dielectric strength.

Tested and approved by the Underwriters' Laboratories.

Pulp Products Department

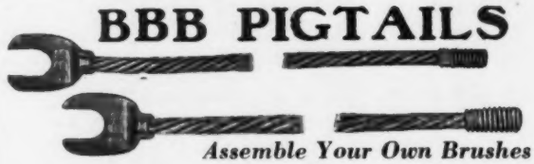
WEST VIRGINIA PULP & PAPER COMPANY

200 Fifth Avenue, New York, N. Y.

732 Sherman Street
Chicago, Ill.

503 Market Street
San Francisco, Cal.

BBB PIGTAILS



Assemble Your Own Brushes

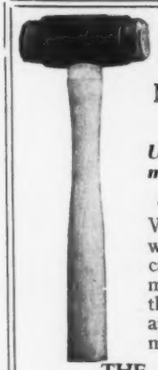
BBB Pigtails can be installed in a brush at a few moments' notice. Brush is drilled at point leader is wanted, hole tapped with correct thread and Pigtail screwed in by hand or pliers. It makes a perfect mechanical as well as electrical connection. This is proven by years of service in actual hard usage.

Write for interesting catalog.

BECKER BROTHERS ELECTRIC CORP.

Manufacturers of BBB Carbon Brushes

23-25 No. Jefferson St., Chicago



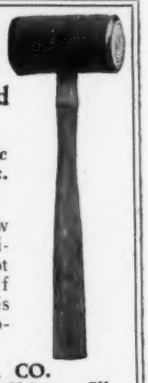
Chicago Rawhide

Mallets and Rawhide-Faced Hammers

Used extensively in electric motor assembly and repair work.

Saves Battered-Up Motor Parts

Will transmit an effective blow without damage to the most delicate surface. The blow is not more destructive to the tool itself than to the object to which it is applied—therefore, doubly economical.



THE CHICAGO RAWHIDE MFG. CO.
1287 Elston Ave., Chicago, Ill.

WAXES

for

Insulated Wires

Made to suit your Conditions
or Requirements
or to your Specifications

Our 33 years' experience
at your command

Special Waxes
for
Special Purposes

E. T. Trotter & Co.

576-602 Johnson Ave.
Brooklyn, N. Y.

Diamond Fibre

SHEETS · RODS · TUBES · SHAPES

DIAMOND STATE FIBRE CO.

Bridgeport, Pennsylvania

Shops and Warehouses Conveniently Located Throughout the Country. Also in Toronto, Canada and London, Eng.

It costs less to buy them

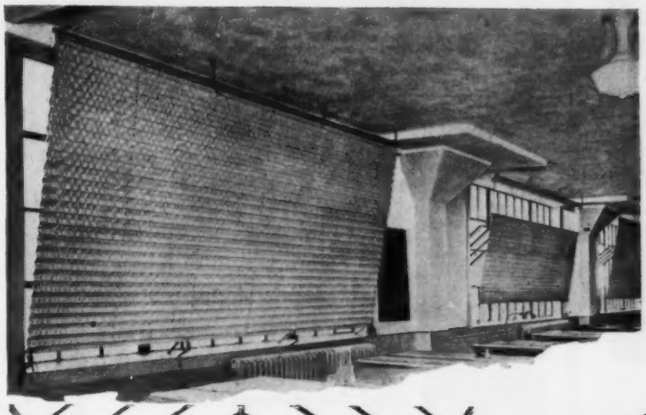
Get the benefit of our quantity production, and remember that each cord set is inspected twice and tested for open and short circuits. We can mold your name or trade mark on the plug.

Iron Heating Elements

Clear India mica. Nickel-chromium wire and asbestos sleeves. Let us quote on your requirements.

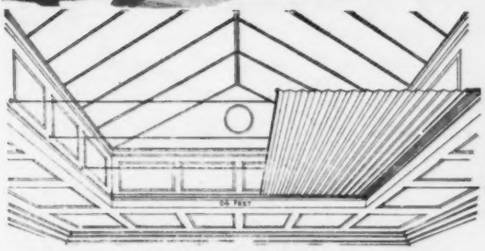
Poloron Electric Mfg. Corp. 20 Bond Street, New York, N. Y.

The Practical Factory Shade



Strong light (without glare).
Shades any part of window.
Lower part of window screened from outside and keeps employes from wasting time looking out of windows.
Allows strong flood of soft light to enter from above.
No waste floor space.
No awnings necessary.
Steel tilting windows open without necessity of touching shade.

There are no springs, catches or mechanical devices to break or get out of order. Adjusts instantly. Used in Factories, Schools, Hospitals and Office Buildings all over America. One company has 27 factories equipped with



The only skylight shade which disappears entirely, giving full volume of light on cloudy days and a translucent light under the sun's rays. Made in any size up to 16 ft. x 30 ft.

Athey Factory Window Shades

Send for Complete Catalog

ATHEY COMPANY

6112 W. 65th ST. CHICAGO

Compound Cooler

FJS

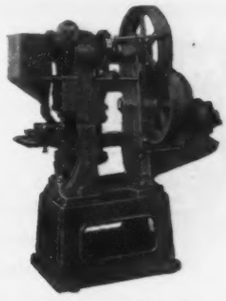
Symbol of Continuous Progress

Standard STOKES Equipment

for

IMPREGNATING and PREFORMING

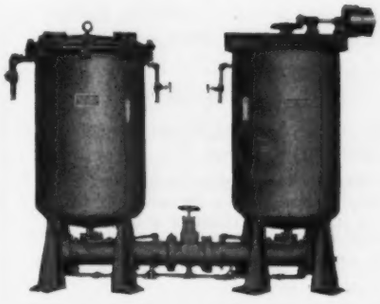
ready to help cut cost, speed up production, save labor, or otherwise help solve your process problem.



Pilling or Preforming Press

Check off on the list of processes below the ones of interest to you and write for information about the STOKES machines which can help bring more profit to your process.

Products made on Stokes Compressing Machines



Vacuum Impregnating Apparatus

IMPREGNATING
COOLING
SOLVENT RECOVERY
WIRE DRYING
DEODORIZING

PREFORMING
COMPRESSING
MEASURING
MIXING
DISTILLING

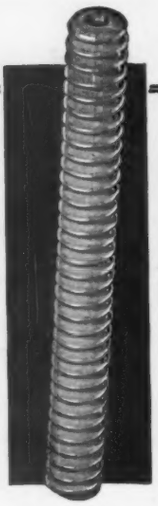
FJS STOKES MACHINE COMPANY

Process Machinery Since 1895

5826 Tabor Road, Olney P. O., Philadelphia, Pa.

Porcelava

The best for Electric Heating Appliances



Our clay specialties, plain and threaded tubes, and Refractory Porcelain for Electric Heating Appliances are superior in every way; and "PORCELAVA" makes the best Pyrometer Insulation.

Burgess & Company
East Liverpool, Ohio
Factory at Wellsville, O.

Chicago Representative:
F. D. FARNAM & CO.
359 No. Wells St., Chicago, Ill.

BEAD CHAIN *for* ELECTRIC FIXTURES

Dependability

From the standpoint of quality, uniformity, and prompt delivery, dependability has made Bead Chain the standard of the industry.

THE BEAD CHAIN MANUFACTURING CO.
BRIDGEPORT CONNECTICUT

Albert Lorsch & Co., Inc., Sales Agents
607 Fifth Avenue
New York City

M-R INSULATION M'F'G CO

"Everything in Insulation"

Compounds, Waxes and Paints
Varnishes and Varnished Materials
Insulating, Waterproofing and Maintenance Paints

Mitchell-Rand Mfg. Co., 19 Vesey St., N. Y.

"Candy's Faultless"

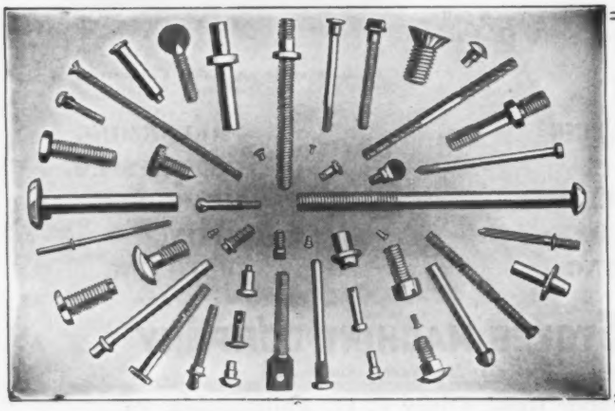
(True to name)

WAXES INSULATING MATERIALS

for Rubber Covered and Weatherproof Wire, Coils, Condensers, Conduit, Wet and Dry Batteries, Wiring Devices, Sockets, Switchboards, etc. MATERIALS TO YOUR OWN SPECIFICATIONS OUR SPECIALTY. Compounds for Radio Parts.

35 Years' Experience in Compounding

CANDY & COMPANY, Inc.
35th and Maplewood Ave., Chicago, Ill.



WHEN IN NEED OF

MACHINE SCREWS
MACHINE SCREW NUTS
SPECIAL STUDS
SPECIAL SCREWS

COMMUNICATE WITH
THE HOUSE OF SERVICE

THE PROGRESSIVE MANUFACTURING CO.
TORRINGTON, CONN.

We please those discriminating manufacturers who not only demand quality but service as well. Business goes where it is invited and remains where it is well treated. The illustration reveals a few only, of the possibilities that are developed by the cold heading process.

M&W Co. 1876

LACQUERS ENAMELS

A Black Enamel That Is *Different*

A Balanced Triangle of exceptional *Adhesion, Hardness* and *Flexibility* has often been attempted but not attained.

Rubber Black Enamel No. 70

A Black Lacquer Enamel for Metal, combining these properties to a degree which makes many other Blacks *Immediately Obsolete.*

We invite your correspondence on your particular problems.

MAAS & WALDSTEIN CO.

Executive Offices and Plant
438 Riverside Ave. Newark, N. J.

Chicago Office and Warehouse 1115 W. Washington Blvd.

Los Angeles Office and Warehouse 1212 Venice Blvd.

The wise motor manufacturer or repairer buys insulating varnish on *specification* rather than price

Specify the conditions under which the electrical apparatus is to operate and we'll tell you the *right* kind of a varnish to use. Have you our catalog?

Benolite Varnish Company, Pittsburgh, Pa.

Benolite

INSULATING VARNISHES

Use our

ELECTRIC TOOLS *for* SCREW DRIVING *and* NUT SETTING

in your production work and save time and labor. We have a number of types to fill most all applications required.

Our Bench Tools are suitable for boy or girl operators. They will double your production.

Send your particular proposition to us.

Users are sending in repeat orders right along.

SEND FOR CIRCULARS ON THE DIFFERENT TYPES.

VIM ELECTRIC TOOL CO., 149 Broadway, New York

LACQUER IT WITH ZELLAC

A BUSINESS MESSAGE ON A LABEL

"There never was a product made
(This truth you must confess),
But what some bird could make it worse
And sell his stuff for less"
ZELLAC

WE have distributed many thousands of these little labels in every field of lacquer use. Everybody knows the fellow who makes inferior materials "and sells his stuff for less!" There are still some lacquer users, however, who have yet to learn through bitter experience the false economy of inferior materials.

For many years we have gone on printed record with the Zeller policy:—*the highest possible quality at the lowest possible price.* Let us deliver you a trial order *specifically formulated to meet your special requirements.* Test the material and compare the prices in relation to the results. Then you will be certain of uniform quality with the utmost finishing economy.

ZELLER LACQUER MFG. CO., Inc.
20 East 49th Street New York City

ZELLAC

FOR EVERY INDUSTRIAL PURPOSE

CHICAGO DENVER
LOS ANGELES SAN FRANCISCO
PORTLAND SEATTLE
WICHITA DALLAS

Send for Catalog Strand *The Standard Line*

FLEXIBLE SHAFTS *and* EQUIPMENT

Power screw driving and nut setting, grinding, polishing, buffing, scratch brushing, drilling, sanding, rotary filing and hundreds of other useful operations. Machines from ⅛ to 2 H.P.

Manufactured by

N. A. STRAND & COMPANY
5001 N. Lincoln St., Chicago, Ill.

ACME HOT AND COLD ROLLED STRIP STEEL

One of the most modern mills in the United States, under supervision of rolling mill experts long in the business, insures users of Acme Strip Steel a quality product, uniform in width, gauge, temper, and finish.

Acme strip is furnished in long continuous length coils or cut-to-length, ¼ to 20 inches wide, in any gauge or temper, and in all finishes, including Electro-Galvanized, up to 12 inches in width.

Whatever your strip steel requirements—for forming, stamping or deep drawing—we invite your inquiries. Our representatives are especially fitted, on account of their technical training and experience, to be of real service to you.

ACME STEEL COMPANY
2840 ARCHER AVENUE
CHICAGO

SPECIAL "FLUXES" AND CORE SOLDER

Developed for the manufacturer, engineer and production manager who has difficult problems in handling resistance wire joints.

"Perfecto" No. 1 Flux—The standard for radio and electrical work. Used by the leading radio and electrical manufacturers.

"Perfecto" No. 2 Flux—Especially for soldering nickel chromium alloys. Endorsed by Gilby Wire Company and Driver-Harris.

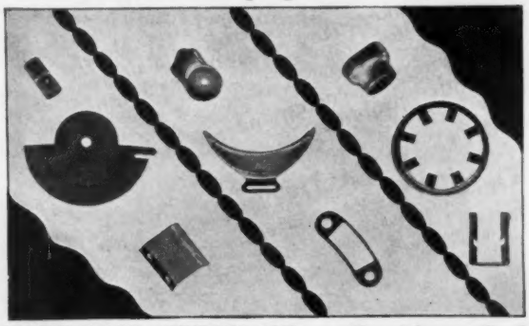
"Perfecto" No. XX 10 Flux—Particularly applicable for resistors.

Firth Core Solder—Made in 1, 1½, 2 and 3 mm. sizes. Non-corrosive, non-acid, non-leaking. This core solder has met with an instant response. Laboratory microscopic tests show its superiority over any core solder on the market today.

Send for samples and results of laboratory tests

FIRTH RADIO CORPORATION
25 Beaver Street, New York *Tel. Hanover 1864*

Small Metal Stampings Accurately Made



PATTON-MacGUYER CO. — Providence, R. I.

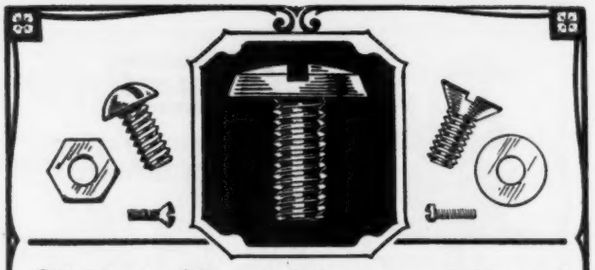
MOLDED PARTS

Bakelite* and *Cold Molded

AICO

Our large and experienced molding organization assures you of efficient service

AMERICAN INSULATOR CORP.
New Freedom, Pa.



All kinds of Electrical Screws carried in stock
WRITE FOR PRICES
NEW ENGLAND SCREW CO.
DEPT. A
44 FARNSWORTH ST. BOSTON, MASS.

Wilson

Contact Points

Thermostatic Metal

—synonymous with worth-while service

The problems of electrical manufacturers who use platinum and silver contact points or thermostatic metal find *final* solution in WILSON.

WILSON realizes fully that such problems require *individual* consideration and, therefore, has built up a most successful organization on the foundation of *finding the answers.*

THE H. A. WILSON COMPANY

WORKERS & REFINERS OF PLATINUM, SILVER & OTHER PRECIOUS METALS
MANUFACTURERS OF WILCO THERMOSTATIC METALS

97 Chestnut Street, Newark, N. J.

For Better Washers

OF BRASS, STEEL AND COPPER
Highest quality—Low prices
Write Us

MASS. MACHINE SHOP, INC.
BOSTON, MASS.

Coil Wire SPRINGS

For all electrical and mechanical manufacturing purposes. All specifications as to quantity and quality are accurately met. Our prices are right and delivery prompt.

Write for Catalog

ADVANCE SPRING & WIRE COMPANY
Carroll Ave. and Wood St.
Chicago, Illinois

Electrical Materials

TESTED FOR

Dielectric Strength
High Voltage Breakdown
Conductivity and Resistance
Chemical Composition
Mechanical Strength
Microscopic Structure
Wearing Qualities
Operating Characteristics

A Written Report to Each Client

Electrical Testing Laboratories
80th St. and East End Avenue New York

ACCURACY-
plus
. . . service on a quantity production basis in screw machine work.
Metal parts for radio condensers, metal inserts for moulded products — countless other items. Send sample or sketch for estimates. Our prices are not the lowest but we guarantee the quality of our workmanship.
THOMASTON MFG. CO.
Thomaston, Conn.

Shakeproof *Lock Washers*

WHEREVER you look—you will find nuts locked this new Shakeproof way. Engineers have developed this better method of locking. Multiple teeth grip the work and the nut preventing turning—vibration only tightens their hold.

New savings in speed and in bolt lengths—a better product in efficiency and appearance accompany the use of Shakeproof.

Unless you are using this washer on your product, send the coupon below for shop test samples.

SHAKEPROOF
Lock Washer Co.
(Division of Illinois Tool Works)
2513 North Keeler Ave., Chicago, Illinois
Patented June 13, 1922.
Other patents pending.

Type 11 External

Type 12 Internal

Type 20 Terminal

FREE SHOP TEST SAMPLES
Shakeproof Lock Washer Co., 2513 N. Keeler Ave., Chicago, Ill.
Please send me samples of
☐ *Shakeproof Lock Washers to fit bolt size*_____
☐ *Shakeproof Locking Terminals, size*_____
*Firm Name*_____
*Address*_____ *Town*_____ *State*_____
*By*_____

Index to Advertisers

Acme Products Co.....105
Acme Steel Co.....126
Advance Spring & Wire Co.....127
Advance Tool & Die Casting Co. 82
Akron Porcelain Company, The. 87
Aluminum Company of America 81
American Insulator Corporation.126
American Lava Corporation. .. 85
Angle Steel Stool Co.....115
Asbestos, Shingle, Slate & Sheathing Co. 117
Athey Company 123

Badger Die Casting Co..... 82
Bakelite Corp. 75
Baker & Company, Inc..... 96
Barnes Co., Wallace.....121
Barnhart Brothers and Spindler.109
Baumbach Mfg. Co., E. A.....109
Bead Chain Mfg. Company, The.124
Becker Brothers Electric Corp..122
Belden Mfg. Company, Inside Front Cover
Benolite Varnish Co 125
Bohn Aluminum & Brass Corp. 18
Brand & Company, William....120
Brandywine Fibre Products Company 93
Brawley, T. R..... 93
Brown-Brockmeyer Co., Inc., The 97
Burgess & Company.....124

Campbell Fibre Company..... 79
Candy & Company, Inc.....124
Case Brothers, Inc.....120
Chace Valve Co., W. M.....108
Chandler Company, The..... 94
Chicago Mica Co..... 85
Chicago Rawhide Mfg. Co., The.122
Clark Metal Products, Inc.....116
Cochrane Chemical Co.....112
Colonial Insulator Company..... 85
Colonial Mica Co..... 90
Connecticut Molded Products Corp., The 79
Conran, Fredk. W.....112
Consumers Rubber Co., The.... 86
Continental Fibre Company, The 91
Cooke Seal Ring Co..... 99
Co-operative Utilities Co., Inc..113
Crane Puller Co..... 99

Davis Slate & Mfg. Company...102
Derby Commutator Co., The...118
Diamond State Fibre Co.....122
Dolph Company, John C..... 94
Dudlo Manufacturing Co..... 13
Dunn, Inc., Struthers..... 99

Electrical Refractories Co., The. 87
Electrical Testing Labs.....127

Fair Haven Marble & Marbleized Slate Co. 102
Fibroc Insulation Co..... 93
Firth Radio Corporation.....126
Fischer Spring Co., Chas., The 104-110
Formica Insulation Co., The.... 4
Franklin Die Casting Corp..... 82

Gair Company, Robert.....11-12
Garfield Mfg. Company..... 92
General Electric Company....20-73
Gibson Co., Wm. D.....105
Gilby Wire Company.....114
Globar Corp. 14
Gorton Machine Company, Geo..118

Handy & Harman 111
Hardy Metal Corporation..... 96
Hartford City Paper Co.....121
Herald Electric Co., Inc.....105
Hinde & Dauch Paper Co., The Back Cover

Illinois Die Casting Co.....109
Impervious Varnish Co..... 94
Industrial Heater Company.....110
International Exhibition Barcelona 119
International Insulating Corp... 69
Interstate Products Corp.....116

Johnson-Bronze Co. 6-7

Kendrick & Davis Company.... 97
Kuhn & Jacob Machine & Tool Co. 79
Kurz Kasch Co..... 77

Leland Electric Co., The..... 95
Linden & Company.....102

Maas & Waldstein Co.....125
Marek & Nebel..... 84
Maring Wire Company.....116
Mass. Machine Shop, Inc.....127
Master Electric Co., The..... 3
Mercer Porcelain Co., Inc..... 96
Mica Insulator Company..... 83
Milwaukee Die Casting Co.....101
Mitchell-Rand Mfg. Co.....124

National Electric Controller Co. 97
National Vulcanized Fibre Co.. 67
National Wax Co.....112
New Departure Mfg. Company, The 19
New England Screw Co.....126
New Jersey Zinc Co., The..... 15
Newton Die Casting Co.....107
Norton Laboratories, Inc..... 92

Ohio Elec. & Controller Co., The 95
Olson Mfg. Company.....102

Parker-Kalon Corp. Inside Back Cover
Patton-MacGuyer Co. 126
Peck Spring Co., The.....118
Phosphor Bronze Smelting Co..120
Platt Bros. & Co., The.....120
Poloron Elec. Mfg. Corp.....122
Portland-Monson Slate Co.....102
Progressive Manufacturing Co., The 124
Pyramid Products Co. 118

Reade Mfg. Co.....104
Recto Mfg. Co..... 92
Rochester Glass Products Co.... 90
Rogers Paper Mfg. Co., The....121
Rome Electrical Company, Inc...116
Rubicon Mfg. Co.....113
Ruby Chemical Co., The.....104

Sargent, Lester L..... 94
Schneider Brothers, Inc..... 79
Scranton Button Co., The..... 71
Shakeproof Lock Washer Company 128
Shaw Insulator Company..... 92
Sherman Mfg. Co., H. B.....113
Sorgel Electric Company..... 99
Standard Alloy Wire Co., Inc..116
Star Porcelain Company, The... 87
Steinin & Company, William...102
Stewart Die Casting Corp., The.103
Stokes Machine Co., F. J.....123
Strand & Co., N. A.....125

Thomaston Mfg. Co.....127
Thordarson Elec. Mfg. Co.....114
Torrington Co., The..... 10
Trotter & Co., E. T 122
Twin City Die Casting Co..... 82

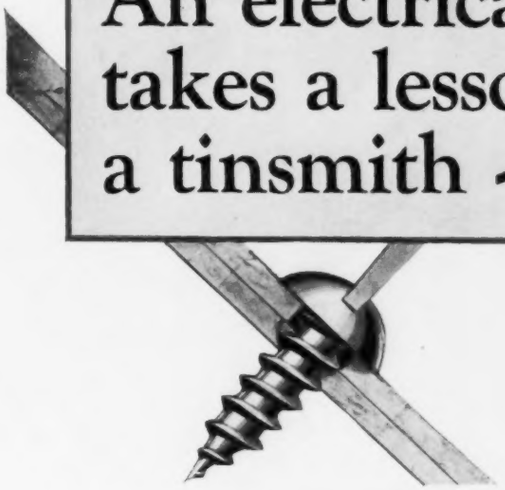
Udylite Process Co., The..... 17
Union Electric Mfg. Company.. 97
United States Shipping Board.. 16
Universal Winding Company...118

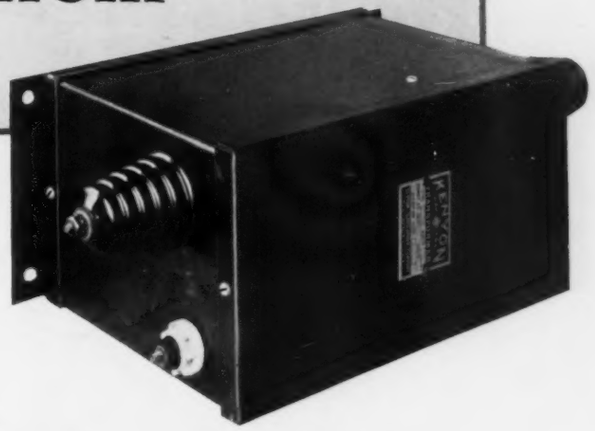
Vim Electric Tool Co.....125

Ward Leonard Electric Company. 40
Waukegan Chemical Company.. 94
Weston Elec'l Instrument Corporation 97
West Virginia Pulp & Paper Co.122
Wiegand Co., Edwin L..... 89
Wilmington Fibre Specialty Co.. 91
Wilson Co., H. A.....127
Wisconsin Electric Co.....8-9
Woolley, Inc., W. Douglas..... 96

Zapon Co., The.....Front Cover
Zeller Lacquer Mfg. Co., Inc....125
Zierick Machine Works, F. R...118
Zobell Electric Motor Corp..... 95

An electrical manufacturer takes a lesson from a tinsmith - - -





. . . *and saves 40% to 50% on an assembly operation by using Self-tapping Screws*

An engineer of the Kenyon Transformer Co., New York, one day watched a tinsmith making fastenings to sheet metal with some unique Screws. First, a hole was drilled, and then the Screw was turned in with a screwdriver—without tapping. The Screw cut its own thread, like a tap, as it was turned in, and the sheet metal was drawn tightly together.

Noting how quickly and easily the fastening was made; and how substantial it was, even in light metal, this engineer inquired and learned that the tinsmith was using Parker-Kalon Self-tapping Sheet Metal Screws.

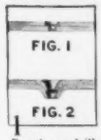
Remembering the slow, troublesome tapping necessary to assemble the sheet metal case of the Kenyon Transformer with machine screws, the engineer got samples of Sheet Metal Screws and tried them for this assembly. He found that these Screws cut the cost of the assembly operation from 40% to 50% by saving the time and expense of tapping. In addition, production was speeded up.

The Kenyon Transformer Co., in adopting Self-tapping Screws for sheet metal assembly, follows the lead of such well-known electrical manufacturers as: General Electric, Western Electric, Westinghouse, Delta Electric and many others who use Self-tapping Screws for making fastenings to sheet metal.

These Screws are so hardened and threaded that they cut their own thread, like a tap, as they are turned in. Fastenings made with Sheet Metal Screws stand up under vibration and severe service conditions. In addition to sheet metal assembly applications, there is a type of Sheet Metal Screw especially for making fastenings to aluminum, die castings, Bakelite, etc.

You, too, may be able to use Self-tapping Sheet Metal Screws to advantage. Try them. Tell us what you want to fasten and we will send suitable samples.

Just two simple operations:



1 Punch or drill a hole as in Fig. 1; or pierce a hole as in Fig. 2.

2 Turn in the Screw with a screw driver.

PARKER-KALON
HARDENED SELF-TAPPING
Sheet Metal Screws

PATENTED
APR. 1, 1919 - No. 1299232 — MAR. 28, 1922 - No. 1411184
AUG. 14, 1923 - No. 1465148 — FEB. 10, 1925 - No. 1526182
OTHERS PENDING

Parker-Kalon Corporation
190-204 Varick Street,
New York, N. Y.

Please send me a handful of Hardened Self-tapping Screws. I want to try them out for

.....

Name .....

Address .....

PARKER-KALON CORP., 190-204 Varick St., New York, N.Y. Distributed in Canada by Aikenhead H'dwre., Ltd., 17-21 Temperance St., Toronto

Are Your Packaging Costs Right?

WE have definite ideas —actual figures—of what packaging should cost. We wonder if our figures agree with yours.

New-day merchandising calls for new-day packaging. What was right and proper for shipping your product four or five years ago may be wholly inadequate today. Smaller units . . . . smaller packages . . . . lighter, stronger shipping boxes are the trend of the times. Packaging has moved from an important factor in *shipping* to a vital factor in *selling* . . . . package costs must be right . . . package designs must be correct.

Place this Staff of Trained Men in Your Service

Hinde & Dauch is ready to match its ideas of packaging costs with yours . . . . no obligation on your part. H & D Package Engineers will study your present ways of packing and show you how engineered packaging will give you the *right* figures.

The Hinde & Dauch Paper Co.
325 Decatur Street Sandusky, Ohio

Write, wire or phone—Hinde & Dauch engineering service is available at the time you say —it's ready now.

H&D

HINDE & DAUCH *corrugated fibre* SHIPPING BOXES